FARLOW LIBRARY
HARVARD UNIVERSITY

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

VOLUME 45

1943

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
52 Garden St., Cambridge, Mass.

JAN 20 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. January, 1943. No. 529.

CONTENTS:

New Oxytrope of the Minnesota-Ontario Border.
Fred K. Butters and E. C. Abbe 1

Revision of the Perennial Species of Geranium of the United States and Canada. *G. Neville Jones and Florence Freeman Jones* 5

Flora of Arizona (Review). *Robert C. Foster* 26

Alchemilla pratensis in Erie County, New York.
Heather G. Thorpe 27

An Important Bibliography (Review). *M. L. F.* 28

New Combination in Pyrus. *F. Hyland* 28

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—**A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.**

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. A limited number of complete sets of the past Issues can now be supplied at a greatly reduced price.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

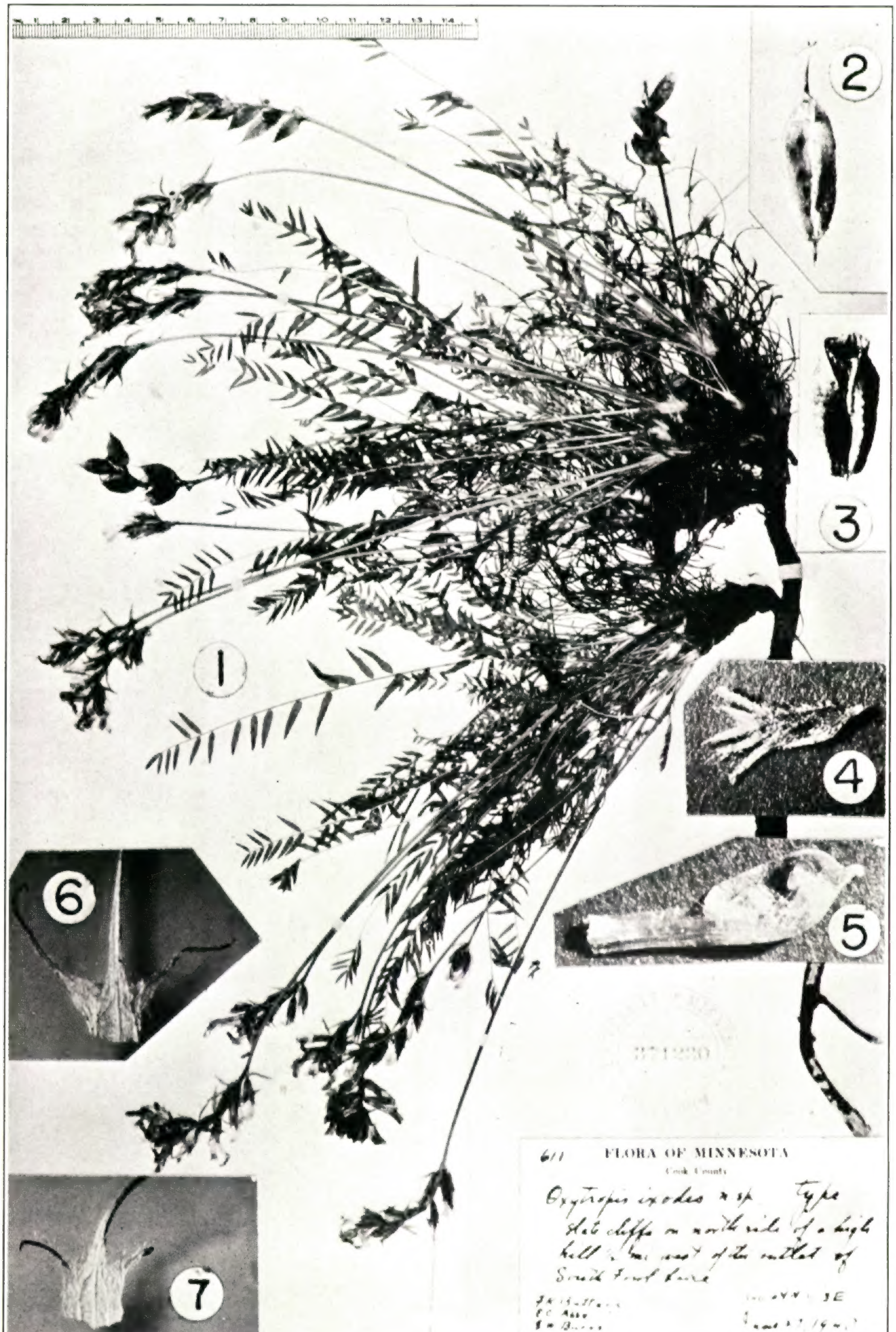
MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

H pl.745



OXYTROPIS IXODES

FIG. 1, TYPE, × 0.37; FIG. 2, full-grown but immature fruit, × 1.5; FIG. 3, last year's fruit, × 1.5; FIG. 4, calyx, × 1.5; FIG. 5, keel, × 3.6; FIG. 6, stipules, × 1.5. Forma ECAUDATA: FIG. 7, stipules, × 1.5.

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. January, 1943. No. 529.

A NEW OXYTROPE OF THE MINNESOTA-ONTARIO BORDER

Fred K. Butters and E. C. Abbe

(Plate 745)

In late July, 1938, Mr. Merrill J. Hendrickson discovered some small plants of a strange looking oxytrope growing on a high hill near South Fowl Lake, Cook County, Minnesota. Mr. Hendrickson was at the time engaged with Mr. G. W. Burns in making a botanical survey for us of the eastern end of the Minnesota-Ontario border.[1] This original find was very fragmentary. Only a single fruiting specimen was discovered, and that was post-mature. It was at once seen that the plant was new to Minnesota, and that it belonged to the group of oxytropes with viscid-glandular inflorescences. It was tentatively identified as *Oxytropis hudsonica* (Greene) Fernald, though it was recognized as considerably more luxuriant than northern specimens of that species.

In the summer of 1939 attempts to find more material of this interesting plant failed completely. Dr. J. W. Moore and the senior author spent several days searching promising looking cliffs of the region in the intervals between a series of torrential thunder storms, but while it later appeared that we had been within a few hundred yards of an abundant growth of the plant we saw no trace of it.

[1] This survey, and other expeditions to the same rather inaccessible region have been rendered possible by grants-in-aid from the Graduate School of the University of Minnesota.

In June, 1940, an expedition consisting of the authors and Mr. Burns repaired to the Fowl Lakes. We met the same weather as before, but after a near shipwreck, and a gale that marooned us for thirty-six hours on an island with an intensely uninteresting flora, we finally reached the south end of the lake and climbed the hill that Mr. Burns indicated as the one where the fragments were collected in 1938. Here, on steep, north-facing slate cliffs that rose two hundred feet above the wooded talus at their base, we found great quantities of our plant in full blossom and early fruit. The previous year Moore and Butters has ascended the same hill only two or three hundred yards farther east, and had seen no trace of it. About the same distance to the west a break in the cliffs led to a more westerly exposure and the plant stopped abruptly. Two days later a second station was located about two miles distant on a similar cliff just east of North Fowl Lake and consequently in Thunder Bay District, Ontario. The plant here was less abundant than at the first station and a little farther advanced. At the time no other differences were noted, but a detailed examination of these specimens has shown that they are slightly different from the Minnesota specimens, particularly in the form of the stipules. Several other cliffs on both sides of the Fowl Lakes were examined carefully but no further stations were discovered, and in the course of several years' botanical exploration in the region no trace of the plant has been seen except at these two very limited stations, so it is certainly extremely local in its occurrence.

While we had tentatively identified the fragments collected in 1938 as *Oxytropis hudsonica*, a study of the abundant material obtained in 1940 soon convinced us that we were dealing with an unknown species, which we are naming *Oxytropis ixodes*[1].

OXYTROPIS **ixodes** sp. nov. TAB. 745. Subacaulis e caudice multicipiti ramis 2–10 mm. crassis 2–10 (18) cm. longis partibus junioribus stipulis petiolisque marcescentibus vestitis senioribus nudis; stipuli membranacei subglutinosi albidi venis viridulis setoso-ciliati et hirsuti pilis albidis (ei marcescentes anni proximi nigrescentes sed setis albidis persistentibus) partibus connatis ad petiolum forte adnatis partibus liberis uninerviis deltoideo-ovatis caudato-acuminatis appendiculo herbaceo 5–20 mm. longo

[1] Gr. ἰξώδης, sticky, clammy, from Ἰξός, mistletoe, an exact equivalent of the latin word, *viscidus*.

1 mm. lato; folia (6) 8–16 (20) cm. longa foliolis 31–51 bijugis anguste lanceolatis vel lineari-lanceolatis acutiusculis (3) 7–17 (23) mm. longis 2–3 mm. latis tenuibus margine revoluto superficie sparse strigoso-villosa et glandulis parvis sessilibus viscida; scapi 15–20 cm. alti foliis aequales vel ea vix superantes sparse strigoso-villosi pilis albidis ca. 1 mm. longis etiam superne hirsuti pilis nigris brevioribus paulum viscidi; spicae dense 6–20 floriferae ad anthesin primam 1.5–3 cm. longae subcapitatae demum longiores (5–6 cm.) laxioresque bracteis lineari-lanceolatis 7–15 mm. longis ca. 2 mm. latis saepe calyces florum superantibus ciliatis sparse villosis pilis albidis nigrisque nonnihil viscidis sparse verrucosis; calyx cylindraceo-companulatus hirsutus pilis albidis et nigris commixtis tubo 5–6 mm. longo dentibus herbaceis nonnihil viscido-verrucosis eis anterioribus lineari-lanceolatis 3–4 mm. longis ca. 0.75 mm. latis, eis posterioribus paulum brevioribus angustissime deltoideis, corolla saturate rubro-violacea[1] petalis ad basin pallidioribus luteolis, vexillo ca. 15 mm. longo 4–5 mm. lato; legumen tenuiter chartaceum oblongo-ellipsoidale in latere ventrali profunde sulcatum subbiloculatum corpore 13–15 mm. longo 5 mm. lato abrupte et acute acuminatum rostello 4–5 mm. longo nigro-strigosum viscidum glandulis minimis sessilibus vix verrucosum.

Cook County, MINNESOTA: slate cliffs of high hill ½ mi. west of the outlet of South Fowl Lake, *G. W. Burns and M. J. Hendrickson* 327, July 27, 1938; *F. K. Butters, E. C. Abbe and G. W. Burns* 611, June 29, 1940 (TYPE in Minnesota herbarium).

It obviously belongs to the rather small group of viscid-glandular species that embraces *O. gaspensis* Fern. & Kelsey and *O. hudsonica* of northeastern North America, *O. viscida* Nutt. and *O. viscidula* (Rydb.) Tidestrom of the Rocky Mountain region and about five Old World species. The glands in *O. ixodes* are somewhat smaller and less verrucose than in the other species, but they can readily be seen with a lens; the whole plant is distinctly viscid when fresh, and stains the drying paper yellow. From *O. viscidula* of the northern Rocky Mountains, which is probably its nearest relative, it differs in its usually longer and more numerous leaflets, longer and narrower sepals, slightly longer and proportionally broader petals, and more deeply sulcate legume. In *O. ixodes* the standard of the flower is 5.5–6.5

[1] The color of the fresh flowers is a deep, rich purple which is a close match for the darkest and most purple of our common "blue" violets. In drying the color blues considerably. A curious *post mortem* character appears on boiling the dried flowers. All the color is quickly extracted except in two spots on the keel where it is much more persistent. These spots are in exactly the same position as the natural blue spots that occur on the keel of *O. gaspensis*.

mm. wide when flattened out, and obcordate, or at least definitely retuse at the apex, in *O. viscidula* about 5 mm. wide, obovate and rounded at the apex. In *O. ixodes* the keel ends in a very short, stubby, rugulose mucro only 0.4 mm. long, which is bent downward; the mucro of *O. viscidula* is a little longer, straight, smooth, and tapering. The legume of *O. ixodes* is papery, somewhat depressed, and very deeply grooved on the ventral surface, that of *O. viscidula* is a little firmer, nearly terete, and only slightly grooved.

From *O. hudsonica*, with which it was at first confused, it differs in its much more luxuriant growth; its more numerous and thinner, narrowly lanceolate leaflets; its inflorescence which soon stretches out to a length of 5–6 cm., while that of *O. hudsonica* is capitate even in fruit; its linear-lanceolate sepals 3–4 mm. long (those of *O. hudsonica* are deltoid and about one-half as long); and in the legume, which is stouter, more abruptly beaked and very obscurely veiny, while that of *O. hudsonica* is conspicuously veiny within.

All of the Minnesota material differs from all of the related species except *O. gaspensis* in the very long, caudate appendages of the stipules, but the small amount of material collected in Ontario is much less distinct in this respect, and also has shorter leaflets. In its flowers and fruits it agrees entirely with the Minnesota plant. It seems best to treat it as a form of *O. ixodes*.[1]

The discovery of *Oxytropis ixodes* adds another very interesting case to the already rather numerous list of species, or groups of closely related species, which are found in the Lake Superior region, the northern Rocky Mountains, and often also in the regions about the Gulf of St. Lawrence and Hudson Bay. In this particular case the isolation has evidently been long enough for each of the groups to develop a set of specific characters of its own.

UNIVERSITY OF MINNESOTA.

[1] OXYTROPIS IXODES forma **ecaudata** forma nov., decedet ex *O. ixodi* typica in partibus liberis stipularum 2–4 mm. longis, acuminatis vix caudatis, foliolis brevioribus 3–10 mm. longis.

Thunder Bay district, ONTARIO: North-facing cliff on the east side of North Fowl Lake on the Minnesota-Ontario border, *Butters, Abbe and Burns* 682, July 1, 1940.

A REVISION OF THE PERENNIAL SPECIES OF GERANIUM OF THE UNITED STATES AND CANADA[1]

G. Neville Jones and Florence Freeman Jones

This paper is a taxonomic revision of the perennial larger-flowered species of *Geranium* occurring spontaneously in North America north of Mexico. Although it would be better to include the numerous Mexican species, the complexity of the taxonomic problems connected with a study of the plants from the region south of the Rio Grande would have necessitated additional time and facilities at present unavailable. We therefore somewhat reluctantly postpone continuation of this work until some future time.[2]

The first general study of the North American species of *Geranium* was published by Torrey & Gray in the first volume of their *Flora of North America* in 1838. Their treatment included three species, *G. maculatum*, *G. albiflorum*, and *G. erianthum*. In 1849, George Engelmann wrote a brief synopsis including seven species. During the first twelve years of the twentieth century two comprehensive systematic studies of *Geranium* were published, the first in 1907 by Hanks & Small in the *North American Flora*, including only the North American species; another study, by R. Knuth, in Engler's *Das Pflanzenreich*, in 1912, is a monograph world-wide in its scope. However, Knuth's treatment of the North American species appears to have been in large part a transcription of the earlier work of Hanks & Small. We have not overlooked the treatment of the Geraniaceae in *Memoirs of the Boston Society of Natural History*, prepared by W. Trelease and published in 1888, a condensation of which appeared in Gray's *Synoptical Flora* in 1897. While possibly of importance at the time of their publication, these treatments are now regarded as of principally historic value, the subject, as noted above, having been more adequately elucidated several years later.

The North American perennial larger flowered species of

[1] Completed with the aid of a grant from the Graduate School of the University of Illinois.

[2] The Mexican species will soon be discussed by Dr. Emery Moore of the Gray Herbarium.

Geranium belong to the sections *Caespitosa* R. Knuth, and *Sylvatica* R. Knuth. Two Mexican species, *G. lentum* and *G. Wislizeni*, whose ranges extend northward into the United States, belong to the section *Mexicana* R. Knuth. In the present paper eighteen species are recognized as occurring in the United States and Canada. One of these, *G. pratense*, is adventive from Europe; one other species, *G. erianthum*, although indigenous on the northwest coast of North America, occurs also in eastern Asia. The remaining species are endemic to North America. They attain their greatest taxonomic development in the western part of the continent, especially in the Rocky Mountain region and in California. Only one species, *G. maculatum*, is confined to the eastern half of the continent.

As is well known, the gynoecium of *Geranium* consists of five carpels cohering into a 5-lobed, 5-loculed ovary. The carpels are arranged around an elongated torus forming a stylar column (the style), often referred to as the "beak", terminating in five stylodia, each stylodium stigmatiferous near the apex of its inner surface. For these free distal ends of the style (often termed stigmas or stylar branches) the term *stylodium* is used in this paper. Each gynoecium has five stylodia. It is not correct to call them stigmas because only the inner surface of the tip of each is stigmatic; the term beak is likewise undesirable on account of its ambiguity. There are four distinguishable parts: (1) the stylar column proper, (2) the tapering, short upper portion of the style, (3) the free tips of the style (stylodia), and (4) the five separate stigmas.

The principal characters yielding significant taxonomic results are: (1) habit of growth; (2) length of mature stylodia; (3) pubescence of petals; and (4) type of indument, particularly of the pedicels, and to a lesser extent, on stem and leaves. The conclusion has been reached that color of petals, taken alone, is of secondary importance, and useful only when employed in conjunction with fundamental morphological characters. In herbarium specimens that have not been carefully prepared, the color of the petals, whether white, pink, or purple may be sometimes rather difficult to satisfactorily determine. Unlike the annual or biennial species, which, as shown by Fernald,[1] often

[1] Rhodora, xxxvii. 295. 1935.

manifest seed characters of outstanding taxonomic value, the seeds of the perennial larger flowered species, contrary to our expectations, have proved to be altogether too uniform for taxonomic purposes.

For the opportunity of completing this study we are indebted to Professor M. L. Fernald, Director of the Gray Herbarium, who first suggested this problem several years ago, and under whose genial guidance the work was begun by the junior author; to Miss Ruth D. Sanderson, Librarian of the Gray Herbarium, thanks are due for able bibliographical assistance in the initial stages of the work. For the loan of specimens in the herbaria under their charge we are indebted to Drs. H. L. Mason, University of California (UC); P. C. Standley, Field Museum (F); M. L. Fernald, Gray Herbarium (G); H. A. Gleason, New York Botanical Garden (NY); and W. R. Maxon, United States National Herbarium (US). Specimens in the Herbarium of the University of Illinois (UI) likewise have been examined. The herbaria containing the specimens cited in this paper are indicated in the usual way by the abbreviations included in the above parentheses (NE = New England Botanical Club).

Taxonomy

Geranium [Tourn.] L.—Perennial to annual herbs; leaves alternate or opposite, stipulate, usually orbicular to reniform, variously palmately lobed or dissected; flowers actinomorphous, on axillary peduncles; sepals 5, imbricate, persistent; petals 5, imbricate, separate, hypogynous, deciduous, alternating with 5 glands; stamens 10 (rarely only 5), hypogynous, usually all antheriferous, five of them longer and alternating with the shorter ones; filaments distinct or only slightly united at the base; ovary 5-carpellate, deeply 5-lobed; styles glabrous within, elastically recoiling at maturity, permanently attached to the carpel-bodies; carpels 2-ovuled, becoming 1-seeded; seeds with folded cotyledons and little or no endosperm.—Sp. Pl. 676 (1753); Bigelow, Fl. Bost. ed. 2, 161 (1824); Elliott, Sketch, ii. 156 (1824); DC. Prodr. i. 639 (1824); Hooker, Fl. Bor.-Am. i. 115 (1830); Torr. & Gray, Fl. N. Am. i. 206 (1838); Gray, Genera Illustr. ii. 127. *t. 150* (1848); Engelm. in Gray, Pl. Fendler. [Mem. Am. Acad. n. s. iv.] 25 (1849); Benth. & Hook. Gen. Pl. i. 272 (1862); Brewer & Watson, Bot. Calif. i. 93 (1880); Trelease in Mem. Bost. Soc. Nat. Hist. iv. 72 (1888), and in Gray, Syn. Fl. i. 358 (1897); Howell, Fl. Nw. Am. 105 (1897); Chapman, Fl. So. U. S. ed. 3, 66 (1897); Small, Fl. Se. U. S. 659 (1903); Hanks & Small

in N. Am. Fl. xxv. 3 (1907); Britton, Manual, ed. 3, 573 (1907); Robinson & Fernald in Gray, Man. Bot. ed. 7, 534 (1908); Coulter & Nelson, New Man. Rocky Mt. Bot. 302 (1909); Knuth in Engler, Pflanzenr. iv. (129) 43 (1912); Britton in Britton & Brown, Illustr. Fl. N. U. S. ed. 2, ii. 426 (1913); Piper & Beattie, Fl. Se. Wash. & Adj. Ida. 154 (1914), Fl. Nw. Coast 154 (1915); Henry, Fl. So. Brit. Columbia, 198 (1915); Wooton & Standley, Contr. U. S. Nat. Herb. xix. 380 (1915); Rydberg, Fl. Rocky Mts., 530 (1917); Bailey, Man. Cult. Pl. 433 (1924); Jepson, Man. Fl. Pl. Calif. 589 (1925); Rydberg, Fl. Prairies & Plains, 499 (1932); Small, Man. Se. Fl. 744 (1933); Munz, Man. So. Calif. Bot. 273 (1935); Jepson, Fl. Calif. ii. 403 (1936); St. John, Fl. Se. Wash. & Adj. Ida. 241 (1937); Peck, Man. Higher Pl. Oregon, 461 (1941).

TYPE SPECIES: *Geranium sylvaticum* L.

SYNOPSIS OF THE SECTIONS

Section I. SYLVATICA R. Knuth in Engler, Pflanzenr. iv (129) 107 (1912).—Caudex usually simple; plants erect, usually single-stemmed, scarcely tufted; basal leaves usually large (8–20 cm. broad); flowers large, the petals 1–2 cm. long.—*G. maculatum, pratense, oreganum, erianthum, viscosissimum, strigosius, Richardsonii, californicum, concinnum, attenuilobum.*

Section II. CAESPITOSA R. Knuth, op. cit. 99.—Caudex branched; plants cespitose, the stems often becoming more or less decumbent; leaves small, usually 2–7 cm. broad; flowers large, the petals 1–2 cm. long.—*G. marginale, Cowenii, Parryi, Fremontii, eremophilum, caespitosum.*

Section III. MEXICANA R. Knuth, op. cit. 196.—Caudex simple or branched; plants ascending or erect; leaves small; flowers small, the petals scarcely 1 cm. in length.—*G. lentum, Wislizeni.*

ANALYTICAL KEY TO THE SPECIES

a. Petals glabrous except at the ciliate base, 1–2 cm. long, purple (rarely white); stylodia short, 1–2.5 mm. in length; fruiting pedicels erect, not bent upward; caudex usually simple, the plants erect, usually single-stemmed, scarcely tufted; divisions of the leaves rhombic in outline, the terminal tooth usually much longer than the others. . . . b.

b. Pedicels and stylar column short-pubescent, not glandular; stylodia one-third to one-half the length of the tapering upper portion (beak) of the stylar column, the latter 3.5–4 cm. long at maturity; filaments sparsely ciliate at base; petioles of the basal leaves and the lower internode of the stem pilose, not glandular. . . . . 1. *G. maculatum.*

b. Pedicels densely glandular-villosulous. . . . c.

c. Filaments sparsely ciliolate at base with trichomes less than 0.5 mm. long; stylodia one-third to one-half the length of the tapering upper portion (beak) of the stylar column. . . . d.

d. Mature stylar column 2.5–3 cm. long, the beak 8–10 mm. long; native of Eurasia, adventive in eastern North America.....2. *G. pratense.*
d. Mature stylar column 3–5 cm. long, the beak 5–7 mm. long; native, western North America from Washington to California west of the Cascade Mountains..3. *G. oreganum.*
c. Filaments conspicuously pilose with trichomes 1–3 mm. long; stylodia one-sixth to one-fourth the length of the tapering upper portion (beak) of the stylar column, the latter 2–3 cm. long at maturity; Alaska and British Columbia; Siberia.....4. *G. erianthum.*
a. Petals pilose on the inner surface one-fourth to one-half their length; stylodia 3–9 mm. long (except *G. Wislizeni*); fruiting pedicels spreading or reflexed and ultimately bent upward....e.
e. Petals pilose inside not more than one-fourth their length....f.
f. Plants usually single-stemmed, erect, the caudex simple; divisions of the leaves rhombic in outline, the terminal tooth usually much longer than the others; stylodia 4–8 mm. long; petals purple to pale lavender, rarely white; inflorescence rather compact, several–many-flowered....g.
g. Petioles of the basal leaves and the lower internode of the stem rather copiously glandular-villous or pilose, and usually with an underlying pubescence of numerous short glandular trichomes.....5. *G. viscosissimum.*
g. Petioles of the basal leaves and the lower internode of the stem strigillose or strigose to rather densely retrorsely pubescent with whitish non-glandular trichomes, less commonly nearly glabrous, not viscid.....6. *G. strigosius.*
f. Plants more or less cespitose, the stems erect, or often decumbent, the caudex usually branched; petals lavender; inflorescence somewhat loosely cymose....h.
h. Pedicels glandless....i.
i. Petals narrowly obovate or oblanceolate; stylodia 3–4 mm. long.....11. *G. marginale.*
i. Petals obcordate or broadly obovate; stylodia 5–7 mm. long.....12. *G. Cowenii.*
h. Pedicels glandular....j.
j. Petioles of the basal leaves and the lower internode of the stem glandular-pubescent.....13. *G. Parryi.*
j. Petioles of the basal leaves and the lower internode of the stem finely retrorsely pubescent to nearly glabrous, not glandular.....14. *G. Fremontii.*
e. Petals pilose on the inner surface one-third to one-half their length....k.
k. Petals 1–2 cm. long, or if slightly shorter, not white....l.
l. Leaf-lobes abruptly attenuate, the caudate tips 4–6 mm. long; stylodia 5 mm. long; pedicels rather densely short-glandular with yellowish trichomes; northern California.....10. *G. attenuilobum.*
l. Leaf-lobes acute to acuminate, or obtusish, not caudate-attenuate....m.
m. Pedicels glandular (rarely glandless in *G. eremophilum*); stylar column more or less glandular....n.
n. Stylodia 3–4 mm. long; petals white or purple-tinged; pedicels usually copiously glandular-villosulous, the trichomes with usually purplish

glands; anthers 1–2 mm. long; filaments 6–9 mm. long.....7. *G. Richardsonii.*
n. Stylodia 4.5–9 mm. long; petals pink or lavender....o.
o. Stems erect, more or less tufted but not profusely branched, the first internode 10–40 cm. long; leaf-lobes usually deeply and sharply incised, the segments lanceolate, acuminate or acute; anthers 2–3 mm. long; California....p.
p. Stylodia 4.5–5.5 mm. long; pedicels rather densely short-glandular; stem and petioles nearly glabrous to finely retrorsely pubescent, sometimes glandular, not villous..8. *G. concinnum.*
p. Stylodia 6–9 mm. long; pedicels glandular-villosulous and often with longer glandless trichomes; stems and petioles villous..9. *G. californicum.*
o. Stems erect or decumbent, cespitose, profusely branched, the first internode 1–8 cm. long; anthers 1–2 mm. long; leaf-lobes usually not sharply incised, the segments oval and acute to obtuse; New Mexico, Arizona.....15. *G. eremophilum.*
m. Plants completely eglandular, the pedicels retrorsely short-pubescent....q.
q. Petals deep rose-purple; stylodia 5–8 mm. long; stems erect or decumbent, profusely branching 16. *G. caespitosum.*
q. Petals white or purple-tinged; stylodia 3–4 mm. long; stem erect, not profusely branching..7. *G. Richardsonii.*
k. Petals 7–9 mm. long, white or pinkish; plants of Mexico, extending northward into New Mexico and Arizona....r.
r. Stems, petioles, and pedicels copiously glandular-villosulous; mature stylar column 2–2.5 cm. long, glandular-pubescent; stylodia 4–5 mm. long.....17. *G. lentum.*
r. Stems and petioles sparsely pilose, not glandular; mature stylar column 1.4–1.8 cm. long, puberulent; stylodia 2–3 mm. long.....18. *G. Wislizeni.*

1. G. MACULATUM L. Perennial with simple caudex; stem solitary, erect, 20–50 cm. tall, varying from glabrous to puberulent, or pubescent with spreading or retrorse trichomes; petioles of the basal leaves 7–20 cm. long, glabrous to strigose, the blades 3–10 cm. broad, roundish in outline, reniform to pentagonal, strigillose, incisely 5-parted, the divisions cuneate, 1–3-lobed, usually rhombic in outline, lobed and cut, acute to acuminate; basal sinus acute to truncate; stipules attenuate-lanceolate, 5–10 mm. long, pubescent; cauline leaves similar, 5–20 cm. broad, 3–7-parted; peduncles 1–5, umbellately arranged, 1–12 cm. long, retrorsely pubescent or hispidulous; pedicels retrorsely short-pubescent, 0.5–5 cm. long, paired, erect in fruit; sepals 7–9 mm. long, oval-lanceolate, minutely pubescent, the outer villous, the inner ciliate, sometimes the long hairs gland-tipped; mucro 2–3 mm. long; petals 1–1.5 cm. long, obovate, entire, or sometimes slightly emarginate, rose-purple or occasionally white, glabrous except at the ciliate base; filaments sparsely ciliolate at the base;

mature stylar column 3.5–4 cm. long, puberulent or sometimes sparsely pilose, the beak about one-fourth to one-third of its total length; stylodia 2 mm. long; carpel-bodies 4–5 mm. long, sparsely hispid with an underlying puberulence; seeds 3–3.5 mm. long, reticulate.—L. Sp. Pl. 681 (1753), ex p.; Michx. Fl. Bor.-Am. ii. 38 (1803); Pursh, Fl. Am. Sept. ii. 448 (1814); Bigelow, Fl. Bost. ed. 2. 256 (1824); Elliott, Sketch Bot. S. C. & Ga. ii. 157 (1824); Raf. Med. Bot. i. 215. *t. 42* (1828); Hook. Fl. Bor. Am. i. 116 (1830), excl. var. β; Gray, Gen. N. Am. Pl. ii. *t. 150* (1849); Macoun, Cat. Can. Pl. i. 90 (1883); Trelease in Mem. Boston Soc. Nat. Hist. iv. 74 (1888), in Gray, Syn. Fl. N. Am. i. 358 (1897); Chapman, Fl. So. U. S. ed. 3. 66 (1897); Small, Fl. Se. U. S. 660 (1903); Hanks & Small in N. Am. Fl. xxv. 12 (1907); Britton, Man. ed. 3. 573 (1907); Robinson & Fernald in Gray, Man. Bot. ed. 7. 535 (1908); Knuth in Engler, Pflanzenr. iv. (129). 113 (1912); Britton in Britton & Brown, Illustr. Fl. N. U. S. ed. 2, ii. 427, *fig. 2653* (1913); Rydberg, Fl. Prairies & Plains, 501 (1932); Small, Man. Se. Fl. 744 (1933); Deam, Fl. Indiana, 624 (1940). *Geranium maculatum* var. *albiflorum* Raf. Med. Bot. i. 217 (1828), *nomen nudum; Geranium maculatum* var. *album* Lauman, in Bailey, Cyclop. Am. Hort. 640 (1900). *Geranium maculatum* var. *plenum* Lauman, l. c. *Geranium maculatum* f. *albiflorum* House, Bull. N. Y. State Mus. ccliv. 243 (1924).—In fields, meadows, and open woods, Quebec to Georgia, westward to Kansas and Manitoba. Type Locality: "*Habitat in* Carolina, Virginia, Sibiria." Representative specimens: Quebec: Isle Perrot, Deux-Montagnes County, *P. Louis-Marie* 5 (G). Maine: Woolwich, Sagadahoc County, *Fernald & Long* 13982 (NE); Orono, *M. L. Fernald*, June 27, 1890 (NE); Falmouth, *E. B. Chamberlain* 393 (NE); Bangor, *O. W. Knight* 1820 (G); North Berwick, *J. C. Parlin*, May 1892 (G). New Hampshire: Derry, *C. F. Batchelder*, May 29, 1913 (UC). Vermont: Snake Mt., Weybridge, *W. W. Eggleston*, June 30, 1892 (NY). Massachusetts: Martha's Vineyard, *F. C. Seymour* 1469 (NY); Wellesley, *Sarah H. Harlow*, May 22, 1889 (NY); Deerfield, Franklin Co., *E. T. & N. Moldenke* 9634 (NY, UI); Amherst, *S. C. Brooks*, June 1907 (UC); Arlington, *A. H. Moore* 2714 (UC); Concord, *S. C. Brooks* 1176 (UC). Rhode Island: Block Island, *R. K. Beattie* 4823 (UI). Connecticut: Southington, *C. H. Bissell* 341 (NY); Waterbury, *C. G. DuBoise*, May 1883 (UC); Berlin, *M. Brandegee* (UC); Norwich, *W. A. Setchell*, May 1883 (UC). New York: Apalachin, *F. E. Fenno* 75 (NY); Staten Island, *N. L. Britton*, May 17, 1891 (NY); West Point, *E. A. Mearns*, June 3, 1883 (NY); Genesee Co., *J. H. White* 69 (UC); Enfield Gorge, *Muenscher & Bechtel* 252 (UC); Henderson's Quarry, *B. Maguire* 6443 (UC); Albany, *H. D. House* 6066 (UC). New Jersey: Oradell, *N. L. Britton*, Oct. 18, 1891 (NY); Clifton,

G. V. Nash 834 (NY); New Brunswick, *F. H. Blodgett*, May 1894 (NY); West Collingswood, Camden Co., *J. W. Adams* 189 (UC). PENNSYLVANIA: Power's Run, Allegheny Co., *O. E. Jennings*, May 25, 1904 (UC); New Bloomfield, Perry Co., *J. W. & M. T. Adams* 2107 (UC); Newton Square, Delaware Co., *J. W. Adams* 1307 (UC); Wawa, Delaware Co., *F. W. Pennell* 14496 (NY); Selinsgrove, Snyder Co., *H. N. Moldenke* 2345 (NY); Lancaster, *J. K. Small*, May 1892 (NY, F). MARYLAND: West Chevy Chase, *Agnes Chase* 2808 (UI). DISTRICT OF COLUMBIA: Fort Totten, *Th. Holm* 281 (UI); Terra Cotta, *Th. Holm*, May 2, 1913 (UI). VIRGINIA: Antioch, Prince William Co., *H. A. Allard* 295 (G, NY); Arlington, *F. Blanchard*, April 19, 1891 (NY), *L. Kelso* 1122 (UC); Williamsburg, *E. J. Grimes* 2643 (NY). NORTH CAROLINA: Lake Junaluska, Haywood Co., *A. L. Price* 182 (NY); Flat Rock, *Mrs. J. Shoolbred* in 1857 (NY); Tar River, Granville Co., *D. S. Correll* 486 (G). SOUTH CAROLINA: Anderson Co., *L. R. Gibbes* in 1885 (NY), Anderson, *John Davis* 1695 (UI); Charleston, *L. R. Gibbes* in 1859 (NY). GEORGIA: Tennille, Washington Co., *R. M. Harper* 2112 (NY); without definite locality, *Chapman* (NY); Stone Mountain, DeKalb Co., *J. K. Small*, May 1895 (NY, F). ONTARIO: Leamington, *John Macoun* 34110 (NY); Kingston, *J. Fowler*, June 5, 1902 (G, NY); Belleville, *John Macoun* 328 (G). MICHIGAN: Haslet, *T. G. Yuncker* 224 (UI); Lansing, *T. G. Yuncker* 171 (UI); Ann Arbor, *C. D. LaRue*, May 30, 1915 (UI). WISCONSIN: Benderville, Brown Co., *H. J. Schuette*, June 9, 1901 (NY); Milwaukee, *H. E. Hasse* (NY); Blue Mounds, Iowa Co., *Clikeman, Drescher, Griswold & Liederman*, May 16, 1932 (UC). MINNESOTA: Prospect Park, *E. P. Sheldon*, May 1895 (NY, UC); Thompson, *J. H. Sandberg* 123 (NY); Bald Eagle, Ramsey Co., *S. F. Blake* 184 (UI). IOWA: Ames, *C. R. Ball*, May 24, 1897 (NY); Floris, *Ada Hayden* 9614 (NY); Cedar Heights, *Myrel Burk* 242 (UI); Davenport, *E. A. Ross*, May 16, 1891 (UC); Fayette Co., *B. Fink* 89 (UC). ILLINOIS: Peoria, *F. E. McDonald*, June 1903 (NY); Carthage, Hancock Co., *F. C. Gates* 10225 (UI); Paxton, *Martha Anderson*, May 25, 1891 (NY); Vermilion River between Oakwood and Collison, Vermilion Co., *G. Neville Jones* 11272, 11332, 13441, 13575 (UI). INDIANA: Clark Co., *C. C. Deam* 27644 (NY); Fort Harrison, Marion Co., *R. C. Friesner* 9597 (NY, UI, UC); Miller, *Agnes Chase* 1525 (UI); Granville, *D. D. Condit* in 1903 (UC); OHIO: Shawnee State Forest, *D. Demaree* 10618 (NY, UC); Berea, *J. R. Watson*, May 1897 (UI). WEST VIRGINIA: Bluefield, *C. F. Millspaugh* 1459 (NY); Ohio Co., *John Pattison*, May 3, 1936 (NY); Ralston Run, Randolph Co., *E. L. Core* 2683 (NY). KENTUCKY: Union Co., *H. T. Shacklette* 289 (NY); without definite locality, *C. W. Short* in 1840 (NY). MISSOURI: Courtney, *B. F. Bush* 7928 (NY, UI); Creve Coeur Lake, St.

Louis, *William Palmer* 1275 (NY); Barracks, *Clara Fuhr*, May 2, 1917 (UI); Forestell, St. Charles Co., *John Davis*, May 25, 1917 (UC). TENNESSEE: Knox Co., *A. Ruth* 2414 (NY); Decatur Co., *G. L. Ames*, May, 1855 (UI); Knoxville, *A. Ruth*, April 5, 1900 (UI). ARKANSAS: Nogo, Pope Co., *G. M. Merrill* 129, 172 (UI). MISSISSIPPI: Grenada, *Vera Millsaps*, May 20, 1932 (UI). ALABAMA: Monte Sano, *C. F. Baker*, May 23, 1897 (NY); Auburn, Lee Co., *Earle & Underwood*, April 25, 1896 (NY). KANSAS: Wyandotte Co., *A. S. Hitchcock* 1138 (NY). NEBRASKA: Long Pine, *J. M. Bates* 1071 (NY).

Geranium maculatum, the common species of eastern North America, is similar to the European *G. pratense*, which is occasionally adventive in northeastern United States. It differs notably in having non-glandular indument.

Linnaeus, in giving the geographical range of this plant, said "*Habitat in* Carolina, Virginia, Sibiria". We now suspect the Siberian plant to be *G. erianthum*, described by DeCandolle, a species which also grows in Alaska, and is closely allied to *G. maculatum* and *G. oreganum*. These four species form a distinct group, separate from the other large-flowered North American species, which are characterized by longer stylodia, abundantly pilose petals, and the reflexed and upwardly bent fruiting pedicels. In *G. maculatum* the stylodia are 1–2 mm. long, the petals ciliate at the base, and the fruiting pedicels erect.

In his *Florula Bostoniensis* (1824), Bigelow comments on *Geranium maculatum* as follows: "As the leaves grow old, they are usually marked with pale spots about the sinuses." This characteristic, also noted by Rafinesque, but apparently not very conspicuous on most specimens, may account for the specific epithet. In fact Rafinesque says "the specific name applies to the root and leaves which are often spotted or mottled; but a variety is spotless."

2. G. PRATENSE L. Perennial with simple caudex; stem 20–60 cm. tall, solitary, erect, retrorsely strigillose on the lower internode; petioles of the basal leaves 10–20 cm. long, retrorsely pubescent; the blades 5–10 cm. broad, orbicular to pentagonal in outline, short-strigose on the upper surface and along the veins on the lower surface, deeply 5–7-parted, the lobes deeply incised, with narrow, acute segments; stipules attenuate-lanceolate, 3–20 mm. long; basal sinus rounded or obtuse; cauline leaves similar, smaller and nearly sessile; inflorescence spreading-cymose, terminal; peduncles 2–8 cm. long, these, as well as the pedicels

and calyces densely glandular-villosulous; pedicels 0.5–2.5 cm. long, paired, erect at maturity; sepals 9–13 mm. long, oval, the mucro 1–2 mm. long; petals 12–20 mm. long, entire or slightly retuse at apex, blue-purple, glabrous except at the very base; filaments ciliolate at the base; mature stylar column 2.5–3 cm. long, densely short-pubescent; stylodia 2–2.5 mm. long; carpel-bodies 4–4.5 mm. long, copiously pilose; seeds slightly reticulate. —Sp. Pl. 681 (1753); Macoun, Cat. Can. Pl. i. 90 (1883); Trelease in Mem. Boston Soc. Nat. Hist. iv. 75 (1888); Hanks & Small in N. Am. Fl. xxv. 13 (1907); Britton, Manual, ed. 3. 573 (1907); Robinson & Fernald in Gray, New Man. Bot. ed. 7. 535 (1908); Knuth in Engler, Pflanzenr. iv. (129). 127 (1912); Britton in Britton & Brown, Illustr. Fl. N. U. S. ed. 2, ii. 420, *fig. 2652* (1913); Bailey, Man. Cult. Pl. 434 (1924).—Native of temperate Eurasia; introduced into North America, and adventive in fields and meadows in northeastern United States and adjacent Canada and Newfoundland; known to occur in Newfoundland, Quebec, Nova Scotia, New Brunswick, Maine, Massachusetts, New York. Type Locality: northern Europe. Representative specimens: Newfoundland: Ferryland, *Betty Watt Brooks*, July 20, 1937 (G); Barred Islands to Fogo Island, *J. D. Sornborger*, Aug. 17, 1903 (G); near Curling, Humber Arm, Bay of Islands, *Fernald & Long* 1848 (G). Quebec: bord des chemins le long de la rivière Dartmouth, Baie de Gaspé, *F. Marie-Victorin* et al. 17325 (G); New Carlisle, Bonaventure County, *Williams & Fernald*, July 27, 1902 (G); Montreal-Ouest, *Marie-Victorin* et al. 45648 (F). Nova Scotia: Bridgewater, *John Macoun* 81525 (F); Yarmouth, *Bissell & Graves* 21738, 21739 (G); Springville, Pictou County, *H. St. John* 1431 (G). New Brunswick: St. Andrew's, *J. Fowler*, June 25, 1900 (G). Maine: Staceyville, Penobscot County, *Fernald*, July 5, 1900 (G). Massachusetts: Swampscott, *L. A. Wentworth*, June 26, 1903 (G).

This introduced species resembles the native eastern North American *G. maculatum*, but may be distinguished by the dense glandular indument on the upper part of the plant, especially on the pedicels. The basal leaf-blades are 5–7-(usually 7-) parted with the divisions cleft into numerous lobes, and the petals are deep purple. *G. maculatum* has the leaf-blades usually 5-parted, the divisions lobed or toothed to a lesser extent, and the petals are paler purple.

3. G. oreganum Howell. Perennial with simple caudex; stem solitary, erect, 40–80 cm. tall, glabrous to pilose and more or less glandular; petioles of the basal leaves glabrous to retrorsely pubescent, 15–40 cm. long; blades 10–12 cm. broad, orbicular to pentagonal in outline, sparsely appressed-pubescent, especially

on the veins, deeply 5–7-lobed, the lobes cuneate and irregularly toothed; basal sinus acuminate; cauline leaves similar, appressed-pubescent, the blades 3–5-cleft; stipules triangular-lanceolate, 5–10 mm. long, chartaceous when dry, puberulent, abundantly ciliate; inflorescence cymose, terminal; peduncles 1–15 cm. long, these as well as the pedicels and calyces glandular-villosulous with purple-tipped trichomes; pedicels paired, 1–3 cm. long, erect in fruit; sepals oval, 7–11 mm. long, with a mucro 2–3 mm. long; petals obovate, deep rose-purple, glabrous except at the ciliate base; filaments ciliate at the base; mature stylar column 3–5 cm. long, densely glandular-pubescent, the beak 5–7 mm. long; stylodia 2 mm. long; carpel-bodies 6–8 mm. long, hispidulous to glandular-pubescent, especially so at the base and along the keel where the trichomes are 1–1.5 mm. long; seeds 3–3.5 mm. long, reticulate.—Fl. Nw. Am. 106 (1897); Piper & Beattie, Fl. Nw. Coast, 228 (1915). *Geranium maculatum* β Hooker, Fl. Bor.-Am. i. 116 (1830). *Geranium albiflorum* β *incisum* Torr. & Gray, Fl. N. Am. i. 206 (1838). *Geranium incisum* Nutt. ex Torr. & Gray, l. c., pro syn. *G. albiflorum* β? *incisum*. Non Andrews, Bot. Rep. i. *t. 67* (1797). *Geranium incisum* sensu Brewer & Watson, Bot. Calif. i. 94 (1880); Trelease, Mem. Boston Soc. Nat. Hist. iv. 74 (1888) ex. p.; M. E. Peck, Man. Higher Pl. Oregon 461 (1941). Non Nutt. ex Torr. & Gray 1838.—Woods, thickets, and meadows, southern Washington to northern California, west of the Cascade Mountains.—Type Locality: "Edge of woods and open places throughout the Willamette valley," [Oregon]. Collected by Thomas Howell. Representative specimens: Washington: Clark Co., *G. Neville Jones* in 1936 (UI). Oregon: Farmington, *Kirkwood* 183 (NY); Forest Grove, Washington Co., *F. E. Lloyd*, June 5, 1893 (NY); without definite locality, *Elihu Hall* 73 (NY, F, G); Wimer, Jackson Co., *E. W. Hammond* 63A (NY, UC); Prospect, Jackson Co., *J. William Thompson* 13087 (NY); Camp Baker, Jackson Co., *Hitchcock & Martin* 5051 (NY); Eugene, Lane Co., *L. Constance* 941 (NY, F, UC, G); without definite locality, *Thomas J. Howell*, June 1880 (NY); Ashland, *E. I. Applegate* 60 (G); Salem, *J. C. Nelson* 1330 (G); "Oregon: *Douglas*" (G); Corvallis, *A. Isabel Mulford*, May 31, 1892 (G), *M. Stason* 2468 (UC); Oswego, *Drake & Dickson*, May 1889 (F); Calapooya Valley, Douglas Co., *M. A. Barber* 132 (G); Fort Klamath, *Coville & Applegate* 303 (F); Estacada, *M. W. Lyon* 112 (F); Beaverton, *Sisters of St. Mary*, May 15, 1916 (UC). California: Strawberry Valley, Siskiyou Co., *H. Edwards*, Aug. 1875 (NY); Siskiyou Mountains, *T. S. Brandegee*, July 1887 (UC); Siskiyou Co., *L. E. Smith* 388, 712 (G); Blocksburg, Humboldt Co., *J. W. Blankinship*, June 22, 1893 (G).

The identity of "*G. albiflorum* β? *incisum*" Torr. & Gray with

G. oreganum Howell is established by the statements of Torrey & Gray that their plant was collected by Thomas Nuttall in Oregon, and that "the petals have a lateral tuft of hairs at the base". It was thus effectively separated from *G. Richardsonii* and other Rocky Mountain species by the disparate geographical range, and the character of the ciliation of the petals. *G. erianthum* is the only other western American species which has this petal character. Any doubt as to the identity of the Nuttall collection from Oregon is immediately dispelled by an examination of a specimen in the Torrey Herbarium (NY) with Nuttall's label bearing the inscription "*Geranium * incisum*". This plant is unmistakably *G. oreganum* Howell. Because of an earlier use of the name *G. incisum* by Andrews in 1797 for a South African species, Howell's name instead of Nuttall's, must be used for this plant. Incidentally, the statement by Torrey & Gray (l. c.) that they had "the same plant [i. e., *G. oreganum* Howell] from Altaic Siberia, sent by Prof. Fischer" indicates that they had in all probability confused it with *G. erianthum* DC., which does grow in Siberia.

The *Geranium maculatum* "β. North-West America. *Douglas.*—Flowers large, handsome, purple." of Hooker's Fl. Bor.-Am. i. 116 (1830) is undoubtedly *G. oreganum* Howell, as shown by a specimen in the Gray Herbarium marked in Dr. Gray's handwriting "Oregon, Douglas, *Hooker*", later inscribed by C. V. Piper " = *G. oreganum* Howell." David Douglas, in his Journal[1] (p. 127), records that he discovered this plant on May 2, 1825, on Menzies Island in the Columbia River, "opposite the Hudson Bay Company's establishment at Point Vancouver," as follows: "(172) *Geranium* sp., perennial; flowers purple; dry meadows; plentiful." There is no doubt that Douglas was describing *G. oreganum*, since this is the only perennial large-flowered species of Geranium occurring in that region.

Geranium oreganum Howell and *G. strigosius* St. John, occupy contiguous geographical areas, and possibly on this account they have been frequently misinterpreted, although they are not particularly closely related. *Geranium oreganum* grows only west of the Cascade Mountains; the trichomes of the erect

[1] Journal kept by David Douglas 1823–1827. Royal Horticultural Society, London, 1914.

fruiting pedicels are tipped with purple glands; the mature stylodia are about 2 mm. long; and the petals are glabrous, or sparsely pubescent only at the base. *Geranium strigosius* grows only east of the Cascade Mountains; its yellowish- or tawny-glandular pedicels are reflexed and bent upward in fruit; the mature stylodia are 4–5 mm. long; the petals are pilose about one-fourth their length; and the leaf-lobes are sharply incised. *Geranium oreganum* is closely related to the eastern North American *G. maculatum*, and to *G. erianthum*, while *G. strigosius* shows evidence of close affinity with the Rocky Mountain species, *G. viscosissimum* and *G. Richardsonii*.

Since *Geranium oreganum* is known to occur only west of the Cascade Mountains, the data accompanying an undoubted specimen of this species, *Henderson* 158 (UC), "Blue Mts., Oregon", are almost certainly an error, caused in all probability by a mixture of labels.

4. G. ERIANTHUM DC. Perennial with simple caudex; stem solitary, erect, 20–60 cm. tall, retrorsely appressed-puberulent or strigillose, or sometimes nearly glabrous below; petioles of the basal leaves 10–30 cm. long; blades 5–10 cm. broad, reniform to pentagonal, deeply 5–7-parted, the lobes rhombic to oval, cleft into three main divisions which are again several times divided; upper surface strigose, the lower surface paler green, strigose or pilosulous along the veins; basal sinus obtuse to truncate; cauline leaves similar, smaller, 2–8 cm. broad, 3–5-parted; stipules triangular-lanceolate, 5–15 mm. long, glabrous, or puberulent at base; inflorescence subcapitate, the short peduncles 0.5–5 cm. long; pedicels 1–several, 0.5–1 cm. long, erect in fruit, glandular-villous with trichomes 1–3 mm. long, and often densely canescent-pilose; sepals 8–10 mm. long, oval, strigillose and often copiously pilose or villous on veins and margins; mucro 1.5–3 mm. long; petals 1.5–2 cm. long, obovate, entire, rose-purple with darker veins, ciliate near base; filaments pilose for about one-third their length, the trichomes 1–3 mm. long; mature stylar column 2–3 cm. long, hispidulous, the stylodia one-sixth to one-fourth the total length of the tapering upper portion (beak) of the stylar column; stylodia 1–2 mm. long; carpel-bodies about 4 mm. long, puberulent, and sparsely hispid, the trichomes 1–3 mm. long with longer glandular pilosity along the keel toward the apex; seeds about 3 mm. long, reticulate.—DC. Prodr. i. 641 (1824); Bongard in Mém. Acad. Sci. St. Pétersb. sér. 6, ii. 129 (1833); Torr. & Gray, Fl. N. Am. i. 206 (1838); Ledeb. Fl. Ross. i. 464 (1842); Macoun, Cat. Can. Pl. i. 90 (1883); Trelease in Mem. Boston Soc. Nat.

Hist. iv. 74 (1888), in Gray, Syn. Fl. i. 358 (1897); Hanks & Small in N. Am. Fl. xxv. 13 (1907); Knuth in Engler, Pflanzenr. iv. (129) 122 (1912); Henry, Fl. So. Brit. Columbia, 198 (1915); Tatew. & Kobay. Contrib. Fl. Aleutian Isl. 60 (1934); Hultén, Fl. Aleutian Isl. 237 (1937).—Abundant on grassy slopes and in valleys, chiefly near the coast, Alaska and British Columbia; Siberia.—TYPE LOCALITY: "in Kamtschatka et Amer. bor. et occidentali. Nelson." Representative specimens: ALASKA: Akutan, *J. M. Macoun* 89604 (NY, US), *I. L. Norberg* 364 (NY); Atka, *W. J. Eyerdam* 1061 (NY); Squaw Harbor, *G. Neville Jones* 8861 (UI); Kings Cove, Alaska Peninsula, *A. Wetmore* 133 (US); Katmai Region, *A. E. Miller*, June 29, 1919 (US); Unimak Island, *W. J. Eyerdam* 2203 (NY); Middleton Island, *E. P. Walker*, June 26, 1922 (NY); Kuiu Island, *Mr. & Mrs. E. P. Walker* 769 (NY, UC, F, US); Fox Bay, *D. Martel* 137 (NY); Shumagin Island, *M. W. Harrington* in 1871–72 (NY); St. Paul Island, *E. C. Johnston*, Aug. 13, 1922 (G), *J. M. Macoun* 89603 (NY, US), *G. Haley*, July 1925 (UC, F); Chignik Bay, *I. L. Norberg* 2 (NY), *C. Flock*, July 2, 1934 (UC); Iliuliuk, *W. L. Jepson* 4, 261a (US); Unalaska, *J. M. Macoun*, July 4, 1896 (NY), *G. Neville Jones* 8955 (UI); Lake Iliamna, *M. W. Gorman* 64 (NY); Hinchinbrook Island, *W. J. Eyerdam*, July 25, 1934 (UC, F); Haines, July 1909, *E. W. Scheuber* (US); McKinley National Park, *Ynes Mexia* 2097 (NY, UC, US); Disenchantment Bay, *F. Funston* 100 (NY, F, UC); Chulitna River, *R. L. Shainwald*, Sept. 11, 1903 (NY); Skagway, *J. P. Anderson* 841 (NY); Windham Bay, *J. D. Culbertson* 4945 (NY, US), 4885 (NY, UC, US); Mt. Dewey, *H. C. Cowles* 1278 (UI, F); Port Hobron, *W. J. Eyerdam* 87 (NY); Olga Bay, Kodiak Island, *Ethel H. & H. B. Looff* 628 (NY), *Ruth Mylroie* 108 (NY); Alitak, Kodiak Island, *Ethel H. Looff*, July–Aug. 1936 (UC); Karluk, *W. T. Horne*, June 1901 (NY), September, 1902 (NY), *C. Rutter* 52 (NY); Popoff Island, *Alice King* (UC); Yakobi Island, *J. P. Anderson* 1378 (US); Juneau, *J. P. Anderson* 531 (NY), *Grace E. Cooley*, July 30, 1891 (NY), *Miss E. A. Shumway*, Aug. 3, 1891 (UC), July 26, 1891 (UI); Sitcha [Sitka], *Bongard* (NY); Baranoff Island, *J. P. Anderson* 266 (US). YUKON: White Pass, *Alice Eastwood* 873 (UC, US). BRITISH COLUMBIA: 9-mile Mountain, northeast of Hazelton, *T. T. McCabe* 8160 (UC); Babine, 11 miles south of Takla Lake, *T. T. McCabe* 8023 (UC); Klappan River, *Preble & Mixter* 633 (US); Queen Charlotte Islands, *Franz Boas* 106 (NY); Copper Mt., Prince of Wales Island, *W. F. Newcombe* 187 (F).

Hultén (1937) summarizes the total geographical area of this species as follows: "Asia: from Vilju distr., Gishiginsk, northernmost Kamtchatka (Cape Gavenski) and Commander Islands

southwards to Amgun R., Ussuri and Honshu. Some few reports north of this area from Anadyr and Chukch Penins. America: from St. Paul Isl., the Aleutian Islands, Alaska Penins., Nushagak and eastwards along the coast to middle S. E. Alaska, also reported from St. Michael north of this area (by Turner)". It extends southward to the Queen Charlotte Islands, British Columbia.

By its restricted geographical range, as well as its several distinctive morphological characters, *G. erianthum* is well-defined and not to be confused with any other North American species. It grows in Siberia, Alaska, Yukon, and northern British Columbia, and is a member of that group of species with purple flowers, short stylodia, and petals ciliate at the base, including *G. pratense* (European), *G. maculatum*, and *G. oreganum*. It differs from those species in having long-pilose filaments, and the stylodia one-sixth to one-fourth the length of the beak of the mature stylar column. The other species of this group have the filaments scarcely ciliolate at the base (the trichomes less than 0.5 mm. long), and the stylodia are about one-third the length of the beak of the mature stylar column.

5. G. VISCOSISSIMUM Fisch. & Mey. Perennial with simple caudex; stems solitary or few, erect, usually 60–90 cm. tall, sometimes only 20–30 cm., the lower internode rather copiously glandular-villous or pilose, and usually with an underlying pubescence of short glandular trichomes; petioles of the basal leaves 10–30 cm. long, glandular-pubescent; blades 6–12 cm. broad, copiously pubescent, roundish-pentagonal in outline, 5–7-parted, the segments rhombic to obovate, deeply and sharply incised, the ultimate lobes usually oblong-lanceolate, acute or acuminate; basal sinus acute; cauline leaves similar, smaller pilose or hispidulous, sometimes glandular, the lobes longer and more tapering, and separated by sinuses of about 60 degree angles; stipules attenuate-lanceolate, 5–15 mm. long, villous, more or less glandular; inflorescence compactly cymose in the early part of the season, later becoming looser; peduncles 1.5–6 cm. long, these, as well as the pedicels and calyces, densely glandular-villous; pedicels in early summer 0.5–1.5 cm. long, erect, later 1.5–3 cm. long, becoming reflexed and bent upward in fruit; sepals 8–12 mm. long, oval to lanceolate, the outer ones densely glandular-villous; mucro 2–3 mm. long; petals 1.2–2 cm. long, entire or emarginate, rose-purple or rarely white, conspicuously dark-veined, pilose about one-fifth their length; filaments ciliate three-fourths their length; mature stylar column 2.5–3

cm. long, densely glandular-villosulous; stylodia 4–5 mm. long; carpel-bodies 5–6 mm. long, glabrate near the apex, glandular-pubescent, with tuft of hairs at the base, the trichomes less than 1 mm. long; seeds 3–4 mm. long, reticulate.—Ind. Sem. Hort. Petrop. xi. suppl. 18 (1846); Rydberg, Contr. U. S. Nat. Herb. iii. 489 (1896), Mem. N. Y. Bot. Gard. i. 264 (1900); Piper, Contr. U. S. Nat. Herb. xi. 379 (1906); Hanks & Small in N. Am. Fl. xxv. 13 (1907); Coulter & Nelson, New Man. Rocky Mt. Bot. 303 (1909); Knuth in Engler, Pflanzenr. iv. (129) 117 (1912); Piper & Beattie, Fl. Se. Wash. & Adj. Idaho, 155 (1914); Henry, Fl. So. Brit. Columbia, 198 (1915); Rydberg, Fl. Rocky Mts. 532 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 337 (1925); Rydberg, Fl. Prairies & Plains, 501 (1932); St. John, Fl. Se. Wash. & Adj. Idaho, 243 (1937); Graham, Ann. Carnegie Mus. xxvi. 259 (1937); Peck, Man. Higher Pl. Oregon, 462 (1941). *Geranium incisum* sensu Newberry, Pac. R. R. Repts. vi. 68 (1857); Trelease in Mem. Boston Soc. Nat. Hist. iv. 74 (1888), ex p. and in Gray, Syn. Fl. i. 359 (1897) ex p.; Howell, Fl. Nw. Am. 106 (1897) ex p. Non Andrews, Bot. Rep. i. t. 67 (1797), nec Nutt. ex Torr. & Gray (1838). *Geranium viscosissimum* var. *album* Suksdorf, Werdenda, i. 24 (1927). *Geranium viscosissimum* f. *album* St. John, Proc. Biol. Soc. Washington, xli. 195 (1928).—Prairies, hillsides, canyons, riverbanks, open woods, and meadows, from British Columbia, Alberta, and Saskatchewan to western South Dakota, northwestern Nevada, and northern California.—TYPE LOCALITY: "Hab. in America septentrionali occidentali". Representative specimens: BRITISH COLUMBIA: Spences Bridge, *John Macoun*, May 30, 1889 (NY); between Kettle & Columbia Rivers, *John Macoun* 63698 (NY, G); Williams Lake, *D. Fraser*, June 18, 1921 (NY); Riske Creek, Chilcotin, *W. A. Newcombe*, June 11, 1915 (G); Ashcroft, *H. C. Cowles* 257 (UI, F); Pavilion Mountain, Lillooet, *T. T. McCabe* 229 (UC); Fraser River, near Marguerite, *T. T. McCabe* 1297 (UC); Alkali Lake, *T. T. McCabe* 945, 1307 (UC); 14 miles north of Kamloops, *T. T. McCabe* 2397 (UC); Merritt, *T. T. McCabe* 4504 (UC); Crow's Nest Pass, *T. T. McCabe* 4894 (UC). ALBERTA: Beaver River, *A. H. Brinkman* 3045 (NY); Medicine Hat, *H. H. Rusby*, July 29, 1915 (NY); foothills of Rocky Mts., *John Macoun* 49, 50 (G); Sarcee Reserve, *Goddard* 407 (UC). WASHINGTON: Almota, Whitman Co., *Constance & Rollins*, et. al. 1074 (NY, F, UC, G); Clark Springs, Spokane Co., *F. O. Kreager* 25 (NY, G, UC), *Beattie & Chapman* 2012, 2021 (UC); Spokane Co., *W. N. Suksdorf* 262 (F, G); Spangle, Spokane Co., *W. N. Suksdorf* 8710 (NY, G, UI, UC); Pullman, *C. V. Piper* 1646 (G), *A. D. E. Elmer* 47 (NY), 2413 (UC); Rock Lake, Whitman Co., *Sandberg & Leiberg* 106 (NY, G, F, UC, UI); Colville Reservation, *Griffiths & Cotton* 409 (NY); Wellpinit, Stevens Co., *L. Constance*

1839 (G, UC); Waitsburg, *R. M. Horner* R115B122 (G); Ellensburg, Kittitas Co., *G. Neville Jones* 10170 (UI). OREGON: Fort Dalles, *Dr. Geo. Suckley* in 1855 (NY); The Dalles, *H. Edwards*, July 1873 (NY), *Harford & Dunn*, June 10, 1869 (NY); Imnaha, Wallowa Co., *M. E. Peck* 17673 (NY). IDAHO: Sawtooth, *B. W. Evermann* 563 (F, NY); Payette National Forest, Valley Co., *J. William Thompson* 13737 (NY, G, F, UC); Beaver Canyon, *C. L. Shear* 3055 (NY), *A. Isabel Mulford*, August 10, 1892 (NY); *A. A. & E. Gertrude Heller* 3155 (NY, UC); Trinity, Elmore Co., *J. F. Macbride* 558 (NY, F, G); Devil Creek, Owyhee Co., *Nelson & Macbride* 1741 (NY, G), 1856 (G); Moscow, Latah Co., *L. F. Henderson* 2752 (G), *LeRoy Abrams* 616 (UC); Henry Lake, Fremont Co., *E. B. & Lois B. Payson* 2019 (G); 15 mi. south of West Yellowstone, *B. & Ruth Maguire* 1188 (UC); Kootenai Co., *Leiberg* 423 (UC). CALIFORNIA: Quartz Valley, Siskiyou Co., *G. D. Butler* 1458 (UC). SASKATCHEWAN: *E. Bourgeau* in 1858 (G). MONTANA: Jack Creek Canyon, *Rydberg & Bessey* 4514 (NY, F, G, UC); Helena, *B. T. Butler* 782, 792, 4042 (NY); Big Fork, *B. T. Butler* 2221, 2223, 2263 (NY); Tobacco Mts., *B. T. Butler*, July 13, 1909 (NY); Midvale, *L. M. Umbach* 171 (NY, F) 560 (NY); Park Co., *F. Tweedy*, June 1889 (NY); Missoula, *W. O. Craig* 8 (NY); Columbia Falls, *R. S. Williams*, July 15, 1894 (NY); Many Glacier, Glacier National Park, *G. Neville Jones* 5343 (NY); Little Belt Mts., *J. H. Flodman* 652 (NY); Missoula, *D. T. MacDougal* 139 (NY); Phillipsburg, *A. C. Titcomb*, July 1884 (G); Miller Canyon, Missoula Co., *C. L. Hitchcock* 1800 (G); Sedan, *B. J. Jones*, July 1901 (G); Big Prairie, Flathead National Forest, *J. E. Kirkwood* 2221 (UC). WYOMING: Big Horn Mts., Sheridan Co., *Tweedy* 78 (NY); Rapid Creek Park, Sheridan Co., *Pammel & Stanton*, July 1897 (NY); Laramie Peak, Albany Co., *Aven Nelson* 7591 (NY, G); Sundance Mt., *Aven Nelson*, July 3, 1896 (NY); Piney and Beaver creeks, *C. C. Curtis*, July 22–31, 1900 (NY); near Leckie, *Merrill & Wilcox* 763 (NY, G); Alpine, Lincoln Co., *Payson & Armstrong* 3491 (UI, G); Moran, Teton Co., *C. L. Hitchcock*, et al. 3864 (UC); Merna, Sublette Co., *E. B. & Lois B. Payson* 2733 (UC). YELLOWSTONE NATIONAL PARK: Mammoth Hot Springs, *F. H. Burglehaus*, July 1893 (UI, UC), *E. A. Mearns* 1975 (NY); Snow Pass, *E. A. Mearns* 3811 (NY); Crescent Hill, *H. L. Mason* 3454 (UC); Undine Falls, *Aven & Elias Nelson* 5691 (NY, G). SOUTH DAKOTA: Rochford, *Rydberg* 584 (G, NY); without definite locality, *John Torrey* in 1875 (G); Deerfield, *E. J. Palmer* 37480 (G); Black Hills, *H. E. Hayward* 1192, 1416, 2189, 2308, 2742 (F).

Geranium viscosissimum and *G. strigosius* are closely allied. They have similar habitats and geographical ranges, and on this account have often been poorly distinguished. However, they

are distinct species, and to the student familiar with them in the field, they present quite different facies. *G. viscosissimum* is darker and coarser on account of the abundant yellowish-green glandular pubescence on the stems, petioles, and often on the leaf-blades. *G. strigosius* is a plant of more delicate and slender habit; it is grayish-green, due to the pale, less glandular indument. As in other species of this genus, occasional plants of *G. viscosissimum* have white petals, a fact which has led certain authors to conclude that the white-flowered plants should be latin-named as a separate variety or form. However, a series of specimens shows that the pigmentation of the petals varies from white to pale lavender to deep purple; no other distinguishing characters are present to uphold the view that the plants characterized by absence of pigment in the petals are genetically separate from the usual purple-flowered ones.

6. G. STRIGOSIUS St. John. Perennial with simple caudex; stem solitary, erect, 30–75 cm. tall, the lower internode strigillose or strigose to rather densely retrorsely pubescent with whitish, non-glandular trichomes, less commonly nearly glabrous, not at all glandular; petioles of the basal leaves puberulent to strigose, 5–25 cm. long; blades 3–10 cm. broad, strigillose or pilosulous on both surfaces, especially along the veins, pentagonal in outline, deeply 5–7-parted, the segments obovate to rhombic in outline, the sinuses acute, the lobes incised, with acute tips; cauline leaves similar, smaller, short-petioled, and with deeper, less intricately lobed divisions; stipules linear-lanceolate, attenuate, 5–20 mm. long, densely puberulent, ciliate; inflorescence terminal, compactly cymose; peduncles 0.5–3 cm. long, pilosulous or more or less glandular; pedicels usually paired, frequently 3 or 4, densely glandular-villosulous, 1–5 cm. long, reflexed and bent upward in fruit; sepals oval, 8–10 mm. long, the outer prominently veined and glandular-villosulous; mucro 1–2 mm. long; petals broadly obovate, emarginate or obtuse, 1.5–2 cm. long, rose-purple, paler at the base with dark veins, pilose less than one-fourth their length; mature stylar column 3–3.5 cm. long, more or less glandular-pubescent; stylodia 4–5 mm. long; carpel-body 6 mm. long, puberulent to glandular-pubescent, especially on the keel; seeds 3.5–4 mm. long, reticulate.—Fl. Se. Wash. & Adj. Idaho, 243 (1937). *Geranium erianthum* sensu Lindley in Edwards, Bot. Reg. *t. 52* (1842); Torrey in Bot. Wilkes Exped. 251 (1874). Non DC. (1824). *Geranium Hookerianum* β *incisum* Walpers, Rep. Bot. Syst. i. 450 (1842). *Geranium maculatum* sensu Engelm. in Gray, Mem. Am. Acad. n. s. iv. 27 (1849). Non L. (1753). *Geranium Richardsonii* sensu Wats. Bot. King Exped.

v. 49 (1871), ex p. Non Fisch. & Trautv. (1837). *Geranium Fremontii* sensu Macoun, Cat. Can. Pl. i. 90 (1883). Non Torr. (1849). *Geranium incisum* sensu Trelease, Mem. Boston Soc. Nat. Hist. iv. 74 (1888), ex p.; Howell, Fl. Nw. Am. 106 (1897); Trelease in Gray, Syn. Fl. i. 359 (1897), ex p.; Hanks & Small in N. Am. Fl. xxv. 14 (1907); Knuth in Engler, Pflanzenr. iv (129). 116 (1912); Taylor in Bailey, Stand. Cyclop. Hort. 1332 (1915); Henry, Fl. So. Brit. Columbia 198 (1915); Rydberg, Fl. Rocky Mts. 532 (1917); Jepson, Man. Fl. Pl. Calif. 590 (1925), Fl. Calif. ii. 405 (1936); St. John, Fl. Se. Wash. & Adj. Idaho, 242 (1937). Non Andrews, Bot. Rep. i. *t. 67* (1797), nec Nutt. ex Torr. & Gray (1838). *Geranium nervosum* Rydberg, Bull. Torr. Club, xxviii. 34 (1901); Hanks & Small in N. Am. Fl. xxv. 18 (1907); Knuth in Engler, Pflanzenr. iv (129). 115 (1912); Rydberg, Fl. Rocky Mts. 531 (1917). *Geranium strigosum* sensu Rydberg, Bull. Torr. Club, xxix. 243 (1902); Hanks & Small in N. Am. Fl. xxv. 13 (1907); Knuth in Engler, Pflanzenr. iv (129). 118 (1912); Rydberg, Fl. Rocky Mts. 532 (1917). Non N. L. Burm., Fl. Cap. Prodr. 19 (1768), nec Franch. in Bull. Soc. Bot. France, xxxii. 442 (1886). *Geranium canum* Rydberg ex Hanks & Small in N. Am. Fl. xxv. 14 (1907); Rydberg, Fl. Rocky Mts. 532 (1917). *G. viscosissimum* sensu E. H. Graham, Ann. Carnegie Mus. xxvi. 259 (1937). Non Fisch. & Mey. 1846.—Hillsides, canyons, open woods, meadows, and stream-banks, British Columbia and Alberta to Montana, Wyoming, western South Dakota, Colorado, Utah, Nevada, and northeastern California.—TYPE LOCALITY: Copperton, Carbon Co., Wyoming. TYPE collected June 20, 1901, by *Frank Tweedy* 4591 (NY). Representative specimens: ALBERTA: Milk River Ridge, *John Macoun* 10079, July 18, 1895 (G); Calgary, *M. E. Moodie* 242 (NY). WASHINGTON: Ellensburg, Kittitas Co., *G. Neville Jones* 10145 (UI); without definite locality, *G. R. Vasey* 218, 219, in 1889 (NY, G); Blue Mts., Walla Walla Co., *C. V. Piper* 2399 (G); Yakima Region, *T. S. Brandegee* in 1882 (UC); Upper Naches River Region, *J. M. Grant*, June 1930 (UC). OREGON: Hilgard, Union Co., *M. E. Peck* 17455 (NY); Canyon City, Grant Co., *G. C. Bellinger*, April 26, 1934 (NY); Blue Mts., Grant Co., *L. F. Henderson* 5323 (G); Steins Mts., *Griffiths & Morris* 586 (NY); Anderson Valley, Steins Mts., *J. B. Leiberg* 2401 (NY, G, F, UC); Powder River Mts., *C. V. Piper*, Aug. 1896 (G); Eastern Oregon, without definite locality, *W. C. Cusick* 2154 (G, UC); Beulah, Malheur Co., *J. B. Leiberg* 2299 (NY, G, UC, F); Swan Lake Valley, Klamath Co., *E. I. Applegate* 967 (UC, F); Pendleton, *W. Sherwood* 208 (F). CALIFORNIA: Warner Mts., Modoc Co., *Mrs. M. H. Manning* 42 (UC); Davis Creek, *Mrs. R. M. Austin*, Aug. 1894 (UC); Goose Lake Valley, *Mrs. R. M. Austin* 2259 (NY, UC); Willow Creek, Modoc Co., *Mrs. R. M. Austin* 218

(UC); Modoc Co., *Milo S. Baker*, July 15, 1893 (NY, UC). MONTANA: Bozeman, Gallatin Co., *V. K. Chestnut & W. W. Jones* 153 (NY), *E. J. Moore*, June 1, 1901 (UC); Flathead National Forest, *J. E. Kirkwood* 2221 (G); Red Lodge, Carbon Co., *C. H. Draper*, June 11, 1905 (UC). WYOMING: Shoshone National Forest, *L. O. & Rua P. Williams* 3748 (NY, G); Big Horn Mts., Sheridan Co., *R. C. Rollins* 501 (NY, G), *F. Tweedy* 2643 (NY); headwaters of Clear Creek and Crazy Woman River, *F. Tweedy* 3647 (NY); Powder River, Big Horn Co., *L. N. Goodding* 286 (NY, F, G); Copperton, Carbon Co., *F. Tweedy* 4591 (type of *G. strigosum* Rydb., NY); Evanston, *J. A. Sanford* 268 (UC); Fish Creek, Teton Forest Reserve, *F. Tweedy* 494 (type of *G. nervosum* Rydb., NY). SOUTH DAKOTA: Black Hills: Deerfield, *H. E. Hayward* 2373 (F); Crooks Tower, *H. E. Hayward* 2742 (F). IDAHO: Tamarack, Washington Co., *June A. Clark* 204 (NY, G, F, UC); Boise, *J. F. Macbride* 263 (NY, G, UC), *June A. Clark* 78 (NY, G, F, UC); Silver City, Owyhee Co., *J. F. Macbride* 959 (F, NY, G, UC); House Creek, Owyhee Co., *Nelson & Macbride* 1819 (NY, G, UC); Pocatello, *Mrs. M. E. Soth* 183 (NY); Corral, Blaine Co., *Macbride & Payson* 2931 (NY, G, UC); Hatwai Creek, Latah Co., *L. F. Henderson* 2753 (G); McCall, Valley Co., *Constance & Pennell* 1972 (G, UC); Tetonia, Teton Co., *B. O. Schreiber* 1215 (UC). UTAH: Silver Lake, *Rydberg & Carlton* 6440 (NY); Salt Lake City, *Rydberg* 6045 (NY), *F. E. Leonard* 123 (NY, UI, UC); Salt Lake Co., *A. O. Garrett* 2380a (NY); Brush Creek Canyon, Uintah Mts., *L. N. Goodding* 1291 (NY, G); Uintah Mts., *H. J. Fuller*, Aug. 10, 1933 (UI); Black Rock, *S. Watson* 204 (NY, G); Bear River, Summit Co., *E. B. & Lois B. Payson* 4829 (NY, G, UC); Abajo Mts., *Rydberg & Garrett* 9243 (NY); Elk Mts., *Rydberg & Garrett* 9562 (NY); La Sal Mts., *Rydberg & Garrett* 8614 (NY); St. George, *E. Palmer* in 1875 (G); Peterson, *Pammel & Blackwood* 3858 (G); Vernal, *E. H. Graham* 6348 (G); Wellsville, *J. A. Moore* 1042 (G); Little Lake, *E. H. Graham* 8220 (F, G); City Creek, *Mrs. Joseph Clemens*, May 28, 1908 (G); Ogden, *W. W. Jones* 414 (G); Cottonwood Canyon, *F. B. Wann* 3538 (UC); Garden City, *R. Hammond* 3537 (UC). NEVADA: Mountain City, Elko Co., *Nichols & Lund* 364 (NY); Gold Creek, Elko Co., *Nelson & Macbride* 2129 (NY, G), *Nichols & Lund* 505 (NY); Martin Creek, Elko Co., *P. B. Kennedy* 4268 (G); Austin, Lander Co., *P. B. Kennedy* 4025 (G); Head of Big Creek, Humboldt Co., *Taylor & Richardson* 75 (UC). COLORADO: Routt Co., *C. S. Crandall*, July 19, 1894 (NY); Grizzly River, near foot of Rabbit Ear Range, *C. S. Crandall* 113 (G); Grizzly Creek, *C. F. Baker*, July 19, 1896 (NY); Gunnison Watershed, *C. F. Baker* 155, 622 (NY, G, UC); between Pallas and Sydney, *Shear & Bessey* 5286 (NY); Mount Carbon, *Tidestrom* 3521 (UC); Tongue Creek Camp, Delta Co., *C. A. Purpus* 305 (F).

Plants of this species resemble in their general habit *G. viscosissimum* and *G. Richardsonii*. They have the purple petals that are pilose less than one-fourth their length, as does the former, but they differ in having the short-pubescent type of indument, glandless on stems and petioles, while *G. viscosissimum* is more or less glandular-villous throughout. In poorly prepared herbarium specimens it is frequently difficult to determine whether the petals are white or purple, and occasionally it is difficult to decide whether a plant belongs to *G. strigosius* or to the white-flowered *G. Richardsonii* which has a similar range, habitat, and habit. In the field, however, the species are instantly distinguishable. The petals of *G. strigosius* are pilose less than one-fourth their length; those of *G. Richardsonii* have indument that extends one-half their length. The pedicels of the latter are always paired; those of the purple-flowered species (e. g., *G. strigosius* and *G. viscosissimum*) sometimes have peduncles bearing more than two flowers. *G. strigosius* is easily distinguished from *G. Richardsonii* by the presence of tawny glandular pubescence on the pedicels of the former, while in the latter the pedicels are densely glandular-villosulous with purple-tipped trichomes.

As previously noted in the discussion under *G. oreganum*, we find that the entity described by Torrey & Gray in 1838 as *G. albiflorum* β? *incisum*, and later given the specific name *G. incisum* by Trelease in 1888, does not represent the Rocky Mountain species (i. e., *G. strigosius*) which has since borne this name, but is instead the Pacific Coast species, *G. oreganum* Howell. We cannot use the name *G. incisum* because this binomial was previously used for a South African species by Andrews in 1797.

In his critical study of the Rocky Mountain species of *Geranium*, Rydberg (1917) treats the entity *G. strigosius* as two species; one with larger, lanceolate, short-hirsute sepals he calls *G. incisum*, the other, with sepals 8 mm. long, oval, densely glandular, as *G. strigosum*. Actually, the type of indument and size of sepals do not show corresponding variation, the dense glandularity occurring on both the large and small sepals. Rydberg also mentioned the strigose foliage of the plant he called *G. strigosum*, but this is another character that does not invariably hold. Examination of a series of specimens shows that there is

only one species. This has been correctly designated by H. St. John (1937) as *G. strigosius* since the name *G. strigosum* is preoccupied.

A few specimens of *G. strigosius* have been collected in northern California. One of these (Davis Creek, *Mrs. R. M. Austin*, Aug. 1894), determined and distributed by E. L. Greene, was labelled by Greene with a manuscript name which was never published. Another of these Californian specimens is from the Warner Mts., Modoc Co. (*Mrs. M. H. Manning* 42), which is the type locality for *G. attenuilobum*. These two species are closely related and are distinguished mainly by the attenuately lobed upper leaves and the usually abundantly pilose petals of *G. attenuilobum*.

(*To be continued*)

A FLORA OF ARIZONA.—This work[1], so long in preparation, is the thorough and scholarly treatment which the reputations of the authors and their twenty-four collaborators would lead one to expect. On the physical side, it is well-printed, the type being rather large and clear, not overly bulky despite its great length, and inexpensive. In addition to the floristic treatment, it contains a brief survey of botanical exploration in Arizona, the geographical relationships of the flora, an illuminating discussion of the vegetation (by Forrest Shreve), and a bibliography dealing with the vegetation and "uses and popular interest." There are, too, a frontispiece and twenty-nine plates (reproduced from photographs), showing vegetation types and interesting species. Nine of these plates are devoted to cacti, and, together with the keys to the genera of that family, these might well be of interest to eastern, as well as western, cactus-fanciers. Interesting as these adjuncts are, however, it is naturally the treatment of the flora (about 3200 species) which must be primarily considered.

In the first place, there are a few minor points of criticism (and they are minor) which are worth making, in anticipation of a reissue or a second edition. It would be of considerable assistance if family names could be used as running-heads to the pages. The family name *Saxifragaceae* is omitted at the beginning of the family treatment. *Iris arizonica* Dykes, described from living plants grown from seed taken from an Arizona collection, probably *Blumer*, no. 1556, is omitted, even from synonymy. Two genera, *Frasera* and *Swertia*, are maintained as distinct, although this might well have been changed had St. John's treatment of the two as *Swertia* appeared before this book went to press. The correct name for *Cuphea ignea* (p. 620) is *C. platycentra* Lem.

[1] ***Flowering Plants and Ferns of Arizona*** **by T. H. KEARNEY AND R. H. PEEBLES AND COLLABORATORS. 1069 pp. U. S. Dept. of Agriculture, Misc. Publ. no. 423. 1942. $2.**

On the other hand, the work seems complete, careful, and, for the most part, conservative, this last characteristic being well shown in the treatment of *Gilia*. There has been no undue slaughter of species, and there is a willingness to recognize varieties generously. Attention has been paid throughout to economic values, especially to forage plants, and to ethnobotanical information. Since descriptions of species could not be included without greatly increasing the bulk (and the price), the keys to genera are highly detailed, and the distributional notes for the species are given more minutely than usual. One notes, too, with pleasure, the restoration of the *Oxalidaceae* to the flora of Arizona. In view of the differences in length, it would be rather unfair to draw comparisons between the contributions of the collaborators, but (possibly from a sense of personal relief), attention might be drawn to Dr. Blake's key to the groups of the *Compositae*, and keys to the genera within these groups. The former is drawn up without mention of style, stigma, or nature of the receptacle. In the latter keys, style- or stigma-characters appear to be used in only three instances; indeed, only once as the primary character in the heading. This must inevitably make the utilization of these keys easier and quicker, even for professional botanists. The ultimate test for such a volume is that of *use*. The writer and some colleagues have, on several occasions, made numerous determinations of Arizona material, with highly satisfactory results. The authors have reached the standards they set for themselves.—Robert C. Foster.

Alchemilla pratensis in Erie County, New York.—A flowering plant of extreme interest and rarity in North America has been added to the flora of western New York State. The species, *Alchemilla pratensis*, F. W. Schmidt, was discovered by me, growing in a long-neglected field near Lancaster, Erie County, New York.

This plant, naturalized from Europe where it is known as "Lady's Mantle," is abundantly naturalized in Nova Scotia, and has occasionally been reported as a local plant from Maine to eastern New York.

Alchemilla pratensis is an attractive non-typical member of the Rose family and of unusual botanical interest. Its flowers, having no petals, are made up of a small greenish cup-shaped calyx that is mainly 4-lobed and bears only 4 stamens. A more unrose-like blossom can hardly be imagined.

A fine specimen collected by me is now growing vigorously in Williamsville, N. Y., in the garden of Professor William P. Alexander, Curator Emeritus of Adult Education, Buffalo Museum of Science.—Heather G. Thorpe, Buffalo Museum of Science.

An Important Biography.—Every botanist, as well as others who are interested in the development of that science, and many more who enjoy getting intimately into touch with a great and lovable man, will want the account of John Torrey by the experienced biographer, Andrew Denny Rodgers III[1]. Torrey, a pioneer in American botany and, at the same time, an investigator in chemistry, was the revered teacher of and, later, collaborator with Asa Gray. He was in close touch with all prominent and less known botanists of his time and the voluminous long-hand correspondence from which Mr. Rodgers has freely drawn gives us a vivid picture of a man as simple and sincere as he was great, if there is any difference. The biography is skillfully and sympathetically prepared. Many readers of Rhodora will want it.—M. L. F.

New Combination in Pyrus.—Prior to a publication on the woody plants of Maine, it appears desirable to publish the following new combination:

Pyrus **decora** (Sarg.), comb. nov. *P. americana* var. *decora* Sargent, Sylva N. Am. **14:** 101, 1902. *Sorbus decora* (Sarg.) Schneider, Bull. Herb. Boiss. II. **6:** 313, 1906; G. N. Jones, Journ. Arnold Arb. **20:** 25, 1939.—F. Hyland, University of Maine.

[1] ***John Torrey, a Story of North American Botany***, by Andrew Denny Rodgers III. Princeton University Press, Princeton, New Jersey, 1942, 352 pp. Price $3.75.

Volume 44, no. 528, including pages 453–511, plates 737–744, and title-page of volume, was issued 26 December, 1942.

FEB 16 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. February, 1943. No. 530.

CONTENTS:

The "Coûdres" of the "Ysle es Couldres." *Bernard Boivin.* 29

Revision of the Perennial Species of Geranium of the United States and Canada (concluded). *G. Neville Jones and Florence Freeman Jones.* 32

Rediscovery of Caltha natans in Minnesota. *Olga Lakela.* 53

Scirpus Longii in North Carolina. *M. L. Fernald* 55

An Invaluable Reference Work (Notice). *M. L. F.* 56

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—**A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.**

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. A limited number of complete sets of the past Issues can now be supplied at a greatly reduced price.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. **February, 1943.** **No. 530.**

THE "COÛDRES" OF THE "YSLE ES COULDRES"

BERNARD BOIVIN

IN 1535, Jacque CARTIER, the discoverer and first explorer of the Saint Lawrence River, found in the Gulf of Saint Lawrence a small island where *Corylus rostrata* was so abundant that he named the island "*l'ysle es couldres*"[1]. *Couldre* was at the time, and still is, the common name in French for *Corylus Avellana*. That common name is equally in use in the French dialects of the following regions: *Bas-Maine, Berry, Nivernais, Normandie*[2]. It is now written *Coûdre*.

The name CARTIER gave to that island is still the only one used to designate it, but the presence of *Corylus* has been recently questioned.

In 1876, R. H. CASGRAIN[3] published a monographic study of this small corner of land. He could not fail to verify if the island still deserves its name, and he effectively found *Corylus rostrata* to be very abundant at the "*Ruisseau à la Lessive*", the very spot where CARTIER landed on September 6, 1535. "*Le paysage*", he adds, "*n'a guère changé d'aspect*".

J. A. G. CREIGHTON[4] also described the Île-aux-Couldres as it stood about 1880. It was then spread over with "*clumps of spruce and cedar, . . . groves of maple and birch and hazel*".

In 1917, Marie-VICTORIN[5] spent a week on the island. He could not find any *Corylus rostrata* but reported from *ouï-dire*

[1] BIGGAR, H. P., The Voyages of Cartier, 1924.
[2] Glossaire du Parler Français au Canada, 234, 1930.
[3] Un Pèlerinage à l'Ile-aux-Couldres, 138, 1876.
[4] GRANT, G. M., Picturesque Canada, **2**: 707–710, 1882.
[5] Can. Field Nat., **33**: 116, 1919.

that there previously were a few. Here is what he writes about the ecological conditions at the *Mouillage:* «Cartier's landing place, the so called "Ruisseau à la Lessive" is yet in its natural state, and it is very hard to believe that the ecological conditions have changed enough in four centuries to expel the hazelnut from the island. Were it not for the express mentioning of the fruits our opinion would be that Cartier was simply mistaken as to the identity of the shrub, and that his hazelnut was nothing else than the Common Northern Alder (*Alnus incana* (L.) Moench) which is very abundant in the damp places about "Ruisseau à la Lessive"».

In the fall of 1936, Marie-VICTORIN took the opportunity of his *Cours de Floristique* to discuss the problem anew. He specified that it was not solved yet, that one should investigate carefully in order to verify whether there were still some *Corylus rostrata* on the *Île-aux-Couldres.*

The following year, Jacques ROUSSEAU[1] fully discussed the problem and considered that the opinions of CASGRAIN and CREIGHTON were just little romances based upon Cartier's text, and that *Corylus rostrata* is now absent from the island.

During the summer of the same year, Marcelle GAUVREAU and Claire MORIN found a few Hazelnuts near the *Pointe des Roches* wharf and brought back herbarium specimens.

In 1942, Jacques ROUSSEAU[2] reconsidered the question and, having learned of the Misses GAUVREAU's and MORIN's collection, he slightly modified his view about the presence of *Corylus rostrata* on the *Île-aux-Couldres: "Il n'en reste plus que quelques arbres au nord de l'île".*

One must note that the phonetic form of the vernacular name most often used in Charlevoix county is **coûdr**. *Coudrier* and *noisettier* are also used, although less frequently, and are accentuated on the last syllable.

Corylus rostrata is certainly one of the plants which are most familiar to the author. Up to 1937, he had gathered its fruits in large quantities every summer, often many bushels in a single season. Later on, having taken a permanent interest in botany, he collected it about half a dozen times and observed it at

[1] Contrib. Lab. Bot. Univ. Mont., **28**: 50, 1937.
[2] Bull. Soc. Géog. de Québec et de Montréal, **1**: 92, 1942.

different stages of its life cycle, in a large number of localities in the Québec Province, from the Matapédia Valley to the Montréal region as well as in New York state and in New England.

It is a shrub found in both natural and artificial habitats; it is locally abundant at the margins of woods, along fences, around rock piles. In the last two habitats, it often forms clumps so dense as to be impenetrable. It grows in deep soils, prefers slopes, more especially the lower part of hills and mountains. It needs a permanent water-table, neither superficial nor too deep, and a permeable soil.

In its natural habitat, it is usually found in mixed woods, sometimes in deciduous woods, more rarely in coniferous woods. It also thrives very well at the margin of the forest along the sea, always in soil conditions similar to those already described in its artificial habitats.

Being present at Marie-Victorin's *Cours de floristique* in the fall of 1936, the author became interested in this problem. Consequently he spent the day of August 24, 1937, on the *Île-aux-Couldres*, with the very purpose of looking for *Corylus rostrata*. In two hours he explored that part of the sea-cliff which runs from the *Pointe des Roches* wharf to the *Cap à Labranche*. And everywhere in the lower part of the cliff, as well as at the margin of the forest along the sea, *Corylis rostrata* is common. As a matter of fact, he never found it elsewhere so abundantly, in its native habitat. Herbarium specimens (no. 1577) were collected, he filled his pockets with fruits, some of which he ate, others he gave to friends, the rest were added to a bag of fruits of the same species collected at Les Eboulements. These fruits were given to the Montreal Botanical Garden for their 1938–39 Index Seminum.

One can safely presume that in Cartier's time, *Corylus rostrata* was equally abundant all along the cliff which nearly surrounds the Island. Nowadays, this cliff has been thoroughly cleared on the south side and the farmers find the land of the island too valuable to spare any for a weedy Hazelnut. But on the north side, especially at the *Mouillage* where Cartier landed, the *couldres* are as abundant to-day as they were four centuries ago.

Gray Herbarium

A REVISION OF THE PERENNIAL SPECIES OF GERANIUM OF THE UNITED STATES AND CANADA

G. Neville Jones and Florence Freeman Jones

(*Continued from page 26*)

7. G. Richardsonii Fisch. & Trautv. Perennial, the usually simple caudex covered with brownish marcescent scale-like leaf-bases and stipules; stems solitary or few, erect, 30–90 cm. tall, glabrous or sparsely pubescent; petioles of the basal leaves 5–20 (rarely 30) cm. long, glabrous or sparsely retrorsely strigose or pilose; blades 3–15 cm. broad, usually pentagonal in outline, deeply 5–7-parted, the rhombic segments several times lobed, lanceolate or ovate, acute or acuminate, sparsely strigose on the upper surface, and along the principal veins on the lower surface; cauline leaves 3–5-parted, sparsely strigose, with sharply incised and tapering lobes, or occasionally the uppermost lanceolate and serrate but not lobed; stipules lanceolate, attenuate, 6–12 mm. long, ciliolate, puberulent, or glabrous; inflorescence spreading-cymose, the peduncles 2–12 cm. long, glandular-pilose, with translucent trichomes 0.5–1 mm. long, tipped with purple glands; pedicels slender, 1–2 cm. long, paired, becoming reflexed and bent upward in fruit, rather copiously glandular-villosulous with straight, mostly purple-tipped trichomes; sepals 6–12 mm. long, lanceolate or narrowly oval, the outer ones more or less glandular-pubescent, at least toward the base or near the margins; mucro 1.5–2.5 mm. long; petals 10–18 mm. long, obovate, obtuse, entire, milk-white, or sometimes pink-tinted, usually with purple or pink veins, pilose inside for about one-half their length; filaments reddish purple, short-pilose three-fourths their length; mature stylar column 2–2.5 cm. long, glandular-villosulous, and with a shorter non-glandular pubescence; stylodia yellowish green, 3–5 mm. long; carpel-bodies 2.5–4 mm. long, sparingly pubescent and with scattered stiff hairs, hispid or glandular-hispid along the keel, the trichomes less than 1 mm. long; seeds 2.5–3.5 mm. long, coarsely reticulate.—Ind. Sem. Hort. Petrop. iv. 37 (1837); Gray, Plantae Fendl. [Mem. Am. Acad. ser. 2. iv.] 25. (1849); Engelm. in Gray, Mem. Am. Acad. n. s. iv. 27 (1849); Brewer & Watson in Bot. Calif. i. 94 (1880); Macoun, Cat. Can. Pl. i. 90 (1883); Trelease in Mem. Boston Soc. Nat. Hist. iv. 75 (1888); Coville in Contr. U. S. Nat. Herb. iv. 76 (1893); Trelease in Gray, Syn. Fl. i. 359 (1897); Howell, Fl. Nw. Am. 106 (1897); Rydberg in Mem. N. Y. Bot. Gard. i. 265 (1900); Hanks & Small in N. Am. Fl. xxv. 18 (1907); Coulter & Nelson, New Man. Rocky Mt. Bot. 303 (1909); Knuth in Engler, Pflanzenr. iv (129). 114 (1912); Hall & Hall, Yosemite Fl. 149 (1912); Wooton & Stand-

ley, Contr. U. S. Nat. Herb. xix. 380 (1915); Henry, Fl. So. Brit. Columbia, 198 (1915); Rydberg, Fl. Rocky Mts. 531 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 337 (1925); Jepson, Man. Fl. Pl. Calif. 590, *t. 584* (1925); Rydberg, Fl. Prairies & Plains, 501 (1932); Raup in Contrib. Arnold Arb. vi. 182 (1934); Munz, Man. So. Calif. Bot. 274, *t. 143* (1935); Jepson, Fl. Calif. ii. 405 (1936); E. H. Graham, Ann. Carnegie Mus. xxvi. 259 (1937); Peck, Man. Higher Pl. Oregon, 462 (1941); Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941). *Geranium albiflorum* sensu Hooker, Fl. Bor.-Am. i. 116, *t. 40* (1830), in Curtis' Bot. Mag. lix. *t. 3124* (1832); Torr. & Gray, Fl. N. Am. i. 206 (1838). Non Ledeb. Icon. Pl. Fl. Ross. i. 6, *t. 18* (1829), and Fl. Altaica, iii. 230 (1831). *Geranium Hookerianum* Walpers, Rep. Bot. Syst. i. 450 (1842). *Geranium pentagynum* Engelmann in Wislizenus, Mem. Northern Mexico, 90 (1848) and in Gray, Mem. Am. Acad. n. s., iv. 27 (1849). *Geranium gracilentum* Greene in Rydberg, Colorado Exp. Sta. Bull. c. 218 (1906). *Geranium loloense* St. John, Fl. Se. Wash. & Adj. Idaho 242 (1937).—Moist open woods and thickets, along creeks, in wet meadows, and springy places on hillsides; common from British Columbia and Saskatchewan southward to South Dakota, New Mexico, and California.—Type Locality: "Vallies in the Rocky Mountains. *Drummond*," between latitudes 52° N. and 54° N.—Representative specimens: British Columbia: Klappan River, *Preble & Mixter* 636 (US); Horsethief Creek, *Titus Ulke* 1253 (NY); along Wicked River, near the Peace, *Raup & Abbe* 3824 (NY, G); North Fork Illecillewaet, *J. M. Macmillian* 565 (NY, G); Mt. Selwyn, *Raup & Abbe* 3791 (G). Idaho: Musselshell Creek, Lolo Trail, Bitter Root Mts., *C. V. Piper* 4027 (NY, isotype of *G. loloense* St. John); Henry Lake, Fremont Co., *E. B. & Lois B. Payson* 1948 (G); Caribou Mountain, Bonneville Co., *Payson & Armstrong* 3523 (G, UI); Lochas River, Idaho Co., *Constance & Rollins* 1677 (G). Utah: Big Cottonwood Canyon, Salt Lake Co., *A. O. Garrett* 1520 (NY, G), *Rydberg & Carlton* 6488 (NY); Hammond Canyon, Elk Mts., *Rydberg & Garrett* 9578 (NY); Western Bear's Ear, Elk Mts., *Rydberg & Garrett* 9350 (NY, G); Gold Basin, La Sal Mts., *Rydberg & Garrett* 9073, 9074 (NY); La Sal Mts., San Juan Co., *H. C. Cutler* 2701 (NY), *E. B. & Lois B. Payson* 4093 (G, UC); Uintah Mts., *L. N. Goodding* 1317 (G); Chain Lakes Trail, Duchesne Co., *F. J. Hermann* 5241 (G); Alta, Wasatch Mts., *M. E. Jones* 1173 (NY, F); Abajo Mts., *Goodman & Hitchcock* 1450 (NY), 1452 (NY, UC, G); Bear River, Summit Co., *G. J. Goodman* 1874 (NY, G); Red Banks, *A. Isabel Mulford* 234 (NY); Fish Creek Canyon, Sevier Co., *A. O. Garrett* 2550 (NY). Nevada: Lake Tahoe, *D. R. Goddard* 1055 (UC); California: Donner Lake, Nevada Co., *C. F. Sonne* 43 (NY, UI, F), *A. A. Heller* 6997 (NY, UC, G);

Tulare Co., *Culbertson* 4382 (NY, UC, F, G); Echo Lake, El Dorado Co., *A. A. Heller* 13348 (NY, G, F, UI); Dry Lake Canyon, San Gorgonio Mts., San Bernardino Co., *Abrams & McGregor* 790 (NY, G); Bear Valley, San Bernardino Mts., *Leroy Abrams* 2831 (NY, G); Bluff Lake, San Bernardino Co., *S. B. Parish* 3784 (G), *I. W. Clokey* 5274 (NY, UC, G); Yosemite National Park, *H. M. Evans*, July 12, 1921 (F); Mill Creek Falls, San Bernardino Co., *S. B. Parish* 5065 (NY); San Bernardino, *W. G. Wright* in 1880 (G); Tioga Road near White Wolf, Sierra Nevada, *F. J. Smiley* 885 (G); Mono Lake, *W. H. Brewer* 1812 (G). ARIZONA: Grand Canyon of the Colorado, *T. F. Allen*, Aug. 1897 (NY); White Mts., Apache Co., *L. N. Goodding* 569 (NY, G), 1197 (NY); 45 mi. n. of Clifton, White Mts., *Kearney & Peebles* 12258 (NY); San Francisco Mt., *J. W. Toumey*, Sept. 10, 1894 (NY), *Cannon & Lloyd*, Aug. 1904 (NY); Rincon Mts., *J. C. Blumer* 3372 (G, UC). ALBERTA: Calgary, *Marion E. Moody* 1054 (NY, G, F, UC), 45 (NY, F); *M. A. Barber* 197 (G); Banff, *Butters & Holway* 89 (G); Lake Louise, *F. W. Hunnewell* 4230 (G). SASKATCHEWAN: *E. Bourgeau* in 1858 (NY, G); Farewell Creek, *John Macoun* 10082 (NY); Cypress Hills, *John Macoun* 74 (F). MONTANA: Glacier National Park, *G. Neville Jones* 5478 (NY, G); Cutbank Creek, Glacier National Park, *C. L. Hitchcock* 2013 (G); Lewis & Clark Forest, *J. E. Kirkwood* 2310 (G); Jones Canyon, Gallatin Co., *E. J. Moore*, July 28, 1900 (G); Sedan, Gallatin Co., *B. J. Jones*, July 28, 1901 (G); Terminus Canyon, *S. Watson* 68 (G); Wilsall, Park Co., *W. N. Suksdorf* 7 (G); Helena, *B. T. Butler*, 778 (NY); Midvale, *L. M. Umbach* 171a (F); Tobacco Mts., *B. T. Butler* 4232 (NY); Little Belt Mts., *J. H. Flodman* 654 (NY); Jack Creek Canyon, *Rydberg & Bessey* 4516 (NY); Big Belt Mts., *J. W. Blankinship*, Aug. 14, 1899 (NY); Summit, *R. S. Williams*, July 25, 1894 (NY). SOUTH DAKOTA: Lower Elk Canyon, *A. C. McIntosh* 1278 (NY); Elk Canyon, *Rydberg* 583 (NY); Elk Creek, Nemo, *G. Neville & Florence Freeman Jones* 14854 (UI); North Rapid Creek Ranger Station, *J. Murdoch* 3003 (NY, F, G); Rapid City, *T. A. Williams* 364 (NY); Spearfish Canyon, *H. E. Hayward* 138 (NY, F); Deadwood, *W. P. Carr* 168 (F, G), *E. J. Palmer* 37063 (G); Boulder Canyon near Sturgis, *G. Neville & Florence Freeman Jones* 14844 (UI). WYOMING: Sheridan Co., *L. O. & Rua Williams* 3206 (NY, G); between Sheridan & Buffalo, *F. Tweedy* 3645 (NY); Battle, Carbon Co., *F. Tweedy* 4594 (NY); Fish Creek, Teton Forest Reserve, *F. Tweedy* 495 (NY); Yellowstone National Park, *F. Tweedy* 232 (NY), *C. H. Hall*, June 1888 (NY), Obsidian Creek, *Aven & Elias Nelson* 6084 (NY, G); *G. Neville & Florence Freeman Jones* 14808 (UI); Shoshone National Forest, Park Co., *L. O. & Rua Williams* 3512 (NY, G); near Centennial, Albany Co., *R. C. Rollins* 935 (NY), *G. Neville & Florence Freeman Jones* 14607

(UI); Antelope Basin, Albany Co., *Aven Nelson* 7491 (NY, G); Pole Creek, *Aven Nelson* 1403 (NY); Shell Canyon, Big Horn Mts., *G. Neville & Florence Freeman Jones* 14827 (UI); Paintrock Creek, Big Horn Mts., *J. G. Jack*, Aug. 4, 1900 (G); Fremont Lake, Sublette Co., *E. B. & Lois B. Payson*, 2858 (G, F, UC); Leckie, *Merrill & Wilcox* 534 (G); Camp Crawford, *Mrs. Joseph Clemens*, Aug. 6, 1908 (G); Willow Creek, *Elias Nelson* 95 (NY), 3369 (F). COLORADO: Headwaters of Clear Creek, east of Middle Park, *C. C. Parry* 112 (NY, G); Four-mile Hill, Routt Co., *C. F. Baker*, July 22, 1896 (NY); Columbine, *F. Tweedy* 4592 (NY); Rio Blanco Creek, Archuleta Co., *R. C. Rollins* 1542 (NY, UI); La Veta, Huerfano Co., *R. C. Rollins* 1285 (NY, G); Lake Brennan, Gunnison Co., *R. C. Rollins* 1455 (NY, G, UI); Mount Carbon, Gunnison Co., *W. W. Eggleston* 5802 (G); So. Park, *Miss E. L. Hughes* 14 (G); La Plata, *Baker, Earle & Tracy* 673 (NY, F, G); Mancos, *Baker, Earle & Tracy* 44 (NY, F, UC, G); Piedra, *C. F. Baker* 449 (G, NY, UC, F, type collection of *G. gracilentum* Greene); Bob Creek, La Plata Mts., *Baker, Earle & Tracy* 195 (NY, F); North Park Range, Routt Co., *L. N. Goodding* 1796 (NY, G); Artist's Glen, Pike's Peak, *H. M. Hall* 10928 (G, UC); Golden City, *E. L. Greene* 62 (G); Georgetown, *M. E. Jones* 836 (NY); Colorado Territory, *C. C. Parry* in 1872 (NY); Twin Lakes, *I. W. Clokey* 3529 (NY, UI, F); Tolland, *L. O. Overholts*, July 3, 1914 (NY); Ouray, *Underwood & Selby* 19,130 (NY); near Lyons, *E. L. Johnston* 694 (G); Fraser, *Johnston & Hedgecock* 678 (G, UC); Wolf Creek Pass, San Juan Mts., Mineral Co., *C. B. Wolf* 3038 (G); Manitou, *M. A. Carleton* 418 (UI); Bosworth's Ranch, *C. S. Crandall* 1147 (G, UI); St. Elmo, Chaffee Co., *R. C. Rollins* 1380 (NY, UI); Pine River, *Mrs. F. Stone* 507 (NY). NEW MEXICO: Ute Park, Colfax Co., *P. C. Standley* 14410 (G, F); Mogollon Mts., Catron Co., *C. B. Wolf* 2635 (G); *H. H. Rusby* 59 (NY, F); Santa Fé, *A. A. & E. Gertrude Heller* 3643 (NY, F, G, UI); Cloudcroft, Sacramento Mts., Otero Co., *E. O. Wooton*, July 18, 1899 (NY); White Mountains, Lincoln Co., *E. O. Wooton* 302 (NY, UI, UC); Middle Fork of the Gila, Mogollon Mts., Socorro Co., *E. O. Wooton*, Aug. 5, 1900 (NY); Redstone, *A. Isabel Mulford* 868 (NY, UI); *A. Fendler* 88 (NY, F, G); Pecos River National Forest, *P. C. Standley* 4013, 4563 (NY, G).

Geranium Richardsonii was first described by Sir William Jackson Hooker as *G. albiflorum* on the basis of specimens collected by Thomas Drummond in the Rocky Mountains of Canada. Hooker's name, published in the *Flora Boreali-Americana* in 1830[1], unfortunately had been antedated by *G. albiflorum*

[1] See B. Daydon Jackson, Bibliographical Notes, in Bull. Herb. Boissier i. 298 (1893) for verification of this date.

Ledeb.[1], an Asiatic species, in 1829. This necessitated the new name *G. Richardsonii* Fisch. & Trautv. for the western North American white-flowered plant. *Geranium Richardsonii* has the most extensive range of any North American species of this genus. It extends from northern British Columbia to New Mexico and California. It has been reported from Cumbre Trojes, District of Temascaltepec, Mexico, by A. A. Bullock (Kew Bulletin 1937: 504. 1938). This is apparently a new southern record. It shows small variations, such as differences of size of flowers and leaves, slenderness of habit, and quantity of indument on various parts of the plant. In alpine situations in the southern part of its range the plants are often much smaller and are frequently cespitose. None of these slight variations appears to have any nameworthy taxonomic significance. The petals are almost always milk-white with pink or purple veins, occasionally varying to pinkish or rose.

The name *G. gracilentum* Greene has been relegated to synonomy under *G. Richardsonii*. The circumstances of the original publication of *G. gracilentum* were rather peculiar. The name was first published in 1906 in Rydberg's *Flora of Colorado*, but no description was given, and the few characters cited were merely part of the key. Eleven years later, Rydberg (1917) put *G. gracilentum* into synonomy under *G. Richardsonii*. In the *Flora of Colorado* the only character relied upon to distinguish *G. gracilentum* from *G. Richardsonii* is the appressed pubescence of the lower part of the stem, the statement in the key being that *G. Richardsonii* has a glabrous stem.

Examination of a series of specimens shows conclusively that *G. loloense* St. John is clearly identical with the common, widely distributed, white-flowered, western North American *G. Richardsonii*. In discussing the relationship of *G. loloense*, St. John compared it with *G. nervosum* Rydb. [i. e., *G. strigosius*], and pointed out several quantitative differences, but apparently overlooked the fact that Rydberg in 1901 had already outlined a similar segregation of species when he separated "*G. nervosum*" from *G. Richardsonii*.

8. G. **concinnum** sp. nov. Perennis, caudice lignoso saepius singulo foliorum basibus stipulisque marcescentibus squamato;

[1] Ledebour, C. F., Icones Plant. Ross. i. 6, *t. 18* (1829).

caulibus singulis vel paucis, erectis, gracilibus, minute retrorso-pubescentibus vel subglabris, 10–50 cm. longis; foliis basalibus subrosulatis, petiolo 8–20 cm. longo, minute retrorso-pubescente vel subglabro; lamina 2–7 cm. lata, reniformi vel pentagona, profunde 5–7-partita, laciniis rhombeis profunde incisis, lobis lanceolatis vel ovalibus utrinque minute adpresseque pubescentibus; foliis caulinis paucis, minoribus, brevius petiolatis caeterum cum basalibus congruentibus; stipulis lanceolatis, puberulis, 4–7 mm. longis; inflorescentia terminali, laxa, gracili, pedunculis saepius facie scaposis, 5–11 cm. longis, minute glanduloso-puberulis, pedicellis 2-jugis, 2.5–11 cm. longis, sub fructu erectis, sat conferte brevi-glandulosis trichomatibus glandulosis luteis vel translucentibus ornatis; sepalis 6–8 mm. longis, ovatis vel lanceolatis, mucrone 1.5–2 mm. longo; petalis 10–15 cm. longis, anguste obovatis, obtusis, integris, pallide violaceis vel roseis, intus ad medium vel tertium superum pilosis; filamentis ad tertium inferum ciliatis; columna stylari evoluta 2–2.5 cm. longa, glanduloso-puberula; stylodiis 4–5 mm. longis; carpidiis 4–5 mm. longis, pubescentibus, secus dorsum glandulosis; seminibus ca. 3 mm. longis, minute reticulatis.

Perennial, the woody, usually simple caudex covered with brownish marcescent scale-like leaf-bases and stipules; stems solitary or few, erect, slender, finely retrorsely pubescent to nearly glabrous, 10–50 cm. tall; basal leaves somewhat tufted, the petioles 8–20 cm. long, finely retrorsely pubescent to nearly glabrous; blades 2–7 cm. broad, reniform to pentagonal, deeply 5–7-parted, the segments rhombic, deeply incised with lanceolate to oval lobes, finely appressed-pubescent on both surfaces; cauline leaves few, smaller, shorter-petioled, but of similar texture and indument; stipules lanceolate, puberulent, 4–7 mm. long; inflorescence terminal, lax, slender, the peduncles often scape-like, 5–11 cm. long, finely glandular-puberulent; pedicels paired, 2.5–11 cm. long, erect in fruit, rather densely short-glandular, the trichomes tipped with yellowish or translucent glands; sepals 6–8 mm. long, oval or lanceolate, the mucro 1.5–2 mm. long; petals 10–15 mm. long, narrowly obovate, obtuse, entire, pale lavender to pink, pilose inside one-half to three-fourths their length; filaments ciliate one-third their length; mature stylar column 2–2.5 cm. long, glandular-puberulent; stylodia 4–5 mm. long; carpel-bodies 4–5 mm. long, pubescent, glandular along the keel; seeds about 3 mm. long, minutely reticulate.—Type Locality: Kern River, Tulare Co., California. A montane species occurring at altitudes of 7000–8000 feet in central and southern California. Specimens examined: California: Kern River, *Culbertson* 4454 (G, type; NY, UC); Bear Valley, San Bernardino Co., *S. B. Parish* 1806 (G, F, UC); Frazier Mt., *Dudley & Lamb* 4536 (UC), *H. M. Hall* 6602 (UC);

Olancha Mountain, Tulare Co., *Hall & Babcock* 5225 (UC); Eagle Creek, Mono Co., *T. M. Hendrix* 349 (UC).

Geranium concinnum is undoubtedly closely related to *G. Richardsonii* on the one hand and to *G. californicum* on the other, constituting in certain respects an entity somewhat intermediate between those two species. It differs from *G. Richardsonii* in its pale lavender or pink petals, its longer stylodia, and in having the trichomes of the pedicels tipped with yellowish or translucent glands. From *G. californicum* it differs in its shorter stylodia, and the puberulence of the stem, petioles, and blades. Apparently it bears about the same relationship to *G. californicum* as does *G. viscosissimum* to *G. strigosius*, or *G. eremophilum* to *G. caespitosum*.

It is apparent that *G. Richardsonii*, *G. concinnum*, and *G. californicum* constitute three closely related species that are distinguished by small but rather definite morphological characters. Their phytogeography and ecological relationships are as yet not too well defined. Further study in the herbarium and especially in the field will be necessary before this perplexing group of species will have been elucidated to the full satisfaction of Californian botanists.

We are giving this plant the specific name *concinnum* on account of its neat and delicate appearance.

9. G. **californicum,** nom. nov. Perennial with a stout, elongate, woody caudex; stems solitary or 2 or 3 and more or less tufted, erect or spreading, 20–70 cm. long, sparsely villous, the scattered trichomes on the lower part of the stem 1–2 mm. in length; upper part of stem sparsely pilose, and with scattered short glandular trichomes; petioles of the basal leaves 5–25 cm. long, sparsely villous; blades 3–8 cm. broad, thin, orbicular to pentagonal in outline, usually 5-parted, the divisions cuneate or rhombic with the smaller lobes acute; upper surface finely strigose, paler and rather copiously hirsute beneath especially along the somewhat prominent veins; cauline leaves similar but smaller; stipules lanceolate, 6–12 mm. long, puberulent or more or less pilose; inflorescence axillary or terminal, sometimes arising directly from the caudex; pedicels in pairs, or sometimes in threes, 1–12 cm. long, copiously yellowish glandular-villosulous and with longer glandless trichomes; sepals oval, 3-veined, thin-margined, 6–9 mm. long, pilose, a few of the hairs gland-tipped; mucro 1.5–2 mm. long; petals narrowly obovate, obtuse, entire, 12–16 mm. long, rose-pink or white, with dark veins, pilose about

half their length; filaments sparsely pilose about one-fourth to one-half their length; mature stylar column 2–2.5 cm. long, rather copiously glandular-villosulous; stylodia 6–9 mm. long; carpel-bodies about 4–5 mm. long, sparsely glandular-hirsute; seeds about 3 mm. long, faintly reticulate.—*Geranium incisum* sensu Brewer & Watson, Bot. Calif. i. 94 (1880), ex p.; Hall & Hall, Yosemite Fl. 148 (1912). Non Andrews (1799), nec Nutt. ex Torr. & Gray (1838). *Geranium leucanthum* Small in N. Am. Fl. xxv. 18 (1907); Knuth in Engler, Pflanzenr. iv (129). 116 (1912); Munz, Man. So. Calif. Bot. 275 (1935), ex p. Non Grisebach in Goett. Abh. xix. 103 (1874), nec Andrz. ex Trautv. in Act. Hort. Petrop. viii. 177 (1883), nom. nud. *Geranium caespitosum* sensu Jepson, Man. Fl. Pl. Calif. 590 (1925), Fl. Calif. ii. 404 (1936), ex p. Non James apud Gray, 1849.—Meadows and open forests, 4000–8000 feet altitude, middle and southern California.—TYPE LOCALITY: Pineridge, Fresno Co., California.—Specimens examined: CALIFORNIA: Pineridge, Fresno Co., *Hall & Chandler* 224 (NY, TYPE of *G. leucanthum* Small; UC); San Bernardino Mts., Yosemite Valley, *J. B. Lembert*, June 1894 (NY); San Jacinto Mts., *H. E. Hasse*, July 2, 1892 (NY); Mariposa Co., *A. Wood* in 1866 (NY); Yosemite Valley, *John Torrey*, in 1872 (NY), *LeRoy Abrams* 4386 (NY, G, UC), *W. H. Brewer* 1674 (G), *H. M. Hall* 9234 (UC); Sierra National Forest, *LeRoy Abrams* 4982 (NY, G); Sierra Nevada Mts., Fresno Co., *F. J. Smiley* 590 (G); Mather, Tuolumne Co., *H. L. Mason* 2139 (G, UC), *H. M. Hall* 11813, 11814 (UC); Tuolumne Co., *E. R. Drew*, July 3, 1887 (UC); North Fork, Madera Co., *R. Bacigalupi* 2272 (UC); Stanislaus National Forest, Tuolumne Co., *I. L. Wiggins* 6810 (UC); Salmon Creek, Tulare Co., *Hall & Babcock* 5147 (UC); Greenhorn Range, Kern Co., *Hall & Babcock* 5048 (UC).

This species has been mistaken for the Rocky Mountain *G. caespitosum*, and for *G. strigosius* [i. e., *G. incisum* of authors], a species which enters California only in the extreme northern part. It has also been called *G. Richardsonii*. In 1907, Small recognized its distinctness from that white-flowered species, giving it the name *G. leucanthum* in allusion to its pale flowers which were erroneously said to be white. Small's name cannot be maintained because that binomial was published by Grisebach in 1874 for a plant of Argentina. We are therefore renaming this species for California, where it is endemic.

Hall & Hall (1912, p. 148) published the following field-notes about this species, which they referred to as *G. incisum:* "This pink-flowered geranium, which grows from thick, perennial

roots, is a pleasing and not uncommon inhabitant of the Yellow Pine Belt. In exposed places the plants are small and very hairy, in the shade they become taller and smoother. Occasionally they produce albino flowers and can then scarcely be distinguished from the next species." [i. e., *G. Richardsonii*].

10. Geranium **attenuilobum,** sp. nov. Perennis, caudice ut videtur simplici; cauli solitario, erecto conferte glanduloso-puberulo; foliis basalibus ignotis, caulinorum petiolo glanduloso, lamina 2.5–6 cm. lata, supra pilosula, pallidiore, subtus secus venas glandulosa, 5-partita, laciniis irregulariter 3-lobis, lobis lanceolatis, acuminatis, lobulo mediano segmenti cujusvis quam caeteris longiore abrupte attenuato vel caudato, cauda 4–6 mm. longa; stipulis lanceolatis, 5–15 mm. longis, dense puberulis, ciliatis; inflorescentia terminali; pedunculis 3–9 cm. longis, glanduloso-puberulis, pedicellis 1–5 cm. longis, sat conferte glanduloso-villosulis, primum reflexis dein sub fructu erectis; sepalis ovalibus, 8–11 mm. longis, glanduloso-pubescentibus, mucrone 2.5–3 mm. longo; petalis obovatis, apice retusis, 12–16 mm. longis, saturate roseis ad medium pilosis; filamentis ad medium vel ad tertium superum pilosis; stylodiis 5 mm. longis; columna stylari evoluta 2.5–3.5 cm. longa, sat conferte glanduloso-pubescente; carpidiis maturis seminibusque haud visis.

Perennial with (probably) a simple caudex; stem solitary, erect, densely glandular-puberulent; basal leaves not seen; petioles of the cauline leaves glandular, blades 2.5–6 cm. broad, pilosulous above, paler and glandular along the veins beneath, 5-parted, the divisions unequally 3-lobed, each lobe lanceolate, acuminate, the middle lobe of each segment longer than the others and abruptly attenuate or caudate, the caudate tips 4–6 mm. long; stipules lanceolate, 5–15 mm. long, densely puberulent, ciliate; inflorescence terminal; peduncles 3–9 cm. long, glandular-puberulent; pedicels 1–5 cm. long, rather copiously glandular-villosulous, reflexed and bent upward in fruit; sepals oval, 8–11 mm. long, glandular-pubescent, the mucro 2.5–3 mm. long; petals obovate, retuse at the apex, 12–16 mm. long, rose-purple, pilose one-half their length; filaments pilose one-half to two-thirds their length; stylodia 5 mm. long; mature stylar column 2.5–3.5 cm. long, rather copiously glandular-pubescent; mature carpels and seeds not seen.—In mountain valleys of Modoc Co., California. Type Locality: Jess Valley, Warner Mountains, Modoc Co., California. Specimens examined: California: Jess Valley, Warner Mountains, Modoc Co., July 24, 1925 *F. H. Frost* 113 (G, type; UC).

This species differs from the other large-flowered North American geraniums by the unique attenuation of the leaf-lobes.

Its loose inflorescence with the several-flowered peduncles points to a probable alliance with *G. strigosius*, but its abundantly pilose petals indicate also a possible affinity with *G. californicum*. We have seen only one collection of *G. attenuilobum*. This consists of the inflorescence and the upper part of the stem. We are giving this plant the specific name *attenuilobum* in allusion to the distinctive attenuate lobing of the upper leaves.

11. G. MARGINALE Rydb. Perennial with branched caudex; stems 10–40 cm. tall, erect or ascending, finely retrorsely pubescent; petioles of the basal leaves 8–18 cm. long, puberulent or finely pubescent; blades 2–3.5 cm. broad, reniform to pentagonal, strigillose or puberulent on both surfaces, 5-parted, the divisions rhombic to obovate, 3-toothed near the apex, the ultimate lobes lanceolate or ovate, acute, with acute sinuses; cauline leaves similar, but usually smaller; stipules triangular-lanceolate, 2–7 mm. long, puberulent, ciliolate; inflorescence cymose, spreading, terminal; peduncles 1–3.5 cm. long; pedicels 1–3 cm. long, more or less retrorsely puberulent with non-glandular trichomes; petals narrowly oblanceolate or narrowly obovate, obtuse, entire, 10–12 mm. long, pale pink or lavendar, pubescent within about one-fourth their length or less, otherwise glabrous; sepals 7–9 mm. long, oval to shortly lanceolate, puberulent to nearly glabrous, narrowly hyaline-margined, 3-veined, the mucro 1–2 mm. long; filaments ciliate one-third their length; mature stylar column puberulent to shortly pilosulous, non-glandular, 1.5–2 cm. long; stylodia 3–4 mm. long; carpel-bodies 4 mm. long; seeds 3 mm. long, faintly reticulate.—Rydberg ex Hanks & Small in N. Am. Fl. xxv. 16 (1907), Fl. Rocky Mts. 533 (1917).—Uplands of Colorado and Utah.—TYPE LOCALITY: Aquarius Plateau, at the head of Poison Creek, Utah. Specimens examined: UTAH: Aquarius Plateau, *L. F. Ward*, Aug. 11, 1875 (G), *Rydberg & Carlton* 7401 (NY, TYPE; G), 7408, 7411, 7415, 7446 (NY); Milford, *F. W. Hill* 154 (UI).

This species occupies a position between *G. caespitosum* and *G. Fremontii*. The glandless indument is like that of the former; the shorter stylodia, and the small amount of pubescence on the petals place it near *G. Fremontii*.

12. G. COWENII Rydb. Perennial with a branched, woody caudex; stems few, tufted, erect, 20–40 cm. tall, the lower internode shortly villous with non-glandular, whitish, somewhat retrorse trichomes about 1 mm. long; petioles of the basal leaves 7–17 cm. long, loosely villosulous with whitish non-glandular trichomes; blades thickish, pentagonal or roundish in outline, 3–6 cm. broad, strigillose on both surfaces, deeply 5-parted, the

divisions rhombic-obovate, deeply 3–5-lobed, the lobes acute; basal sinus acutish; stipules lanceolate, attenuate, villosulous, non-glandular, 5–10 mm. long; cauline leaves similar to the basal ones, smaller, shorter-petioled or sessile; inflorescence terminal, the peduncles erect, 5–15 cm. long, sparsely pilosulous, each 2–3-flowered; pedicels more or less pilosulous with non-glandular trichomes, sometimes slightly glandular in the bud stage, 3–5 cm. long, becoming reflexed and bent upward in fruit; sepals 8–11 mm. long, oval-lanceolate, acutish, narrowly hyaline-margined, puberulent, not at all glandular; mucro 1–2 mm. long; petals lavendar to pale rose-purple, obcordate to broadly obovate, 1.5–2 cm. long, pilose inside about one-third their length; filaments ciliolate about one-third their length; mature stylar column 2–2.5 cm. long, rather closely short-hispidulous, scarcely glandular; stylodia 5–7 mm. long; carpel-bodies ellipsoid, 5 mm. long, pubescent; seeds reticulate.—Fl. Colorado, Bull. 100, Colorado Agr. Exp. Sta. 218 (1906); Hanks & Small in N. Am. Fl. xxv. 16 (1907); Knuth in Engler, Pflanzenr. iv (129). 103 (1912); Rydberg, Fl. Rocky Mts., 532 (1917).—Canyons and mountainsides, Colorado. Type Locality: Rist Canyon, Colorado. Specimens examined: Colorado: Horsetooth Gulch, *C. S. Crandall*, July 15, 1897 (NY); Turkey Creek, *Rydberg & Vreeland* 5917 (NY); Placer Gulch, *Rydberg & Vreeland* 6639 (NY); Rist Canyon, *W. F. Marshall* 1157 (NY, type).

Geranium Cowenii, which is apparently endemic to Colorado, is evidently a member of the "caespitosum" group. and is probably nearly related to *G. marginale*. From *G. Fremontii* it is effectively separated by its somewhat larger flowers, longer stylodia, and non-glandular pubescence.

13. G. Parryi (Engelm.) Heller. Perennial with branched caudex; stems 10–40 cm. tall, tufted, erect, the lower internode and the petioles of the basal leaves, more or less glandular-pilose or glandular-puberulent, with some longer, scattered, whitish, spreading, non-glandular trichomes; petioles of the basal leaves 8–20 cm. long; blades thickish, 2–7 cm. broad, strigose on both surfaces, especially on the veins, reniform to pentagonal in outline, deeply 3–7-parted, the divisions incised to lobed, the lobes rhombic, usually 3-parted; margins glandular-ciliate; basal sinus broad, often truncate; cauline leaves similar, smaller; stipules lanceolate, 7–12 mm. long, glandular-puberulent to glandular-villous; inflorescence spreading-cymose; peduncles 2–8 cm. long, axillary or terminal, glandular-villous with trichomes 1–1.5 mm. long; pedicels usually paired, sometimes in threes, 1.5–5 cm. long, becoming reflexed and bent upward in fruit, rather copiously glandular-villosulous, the straight, spreading

trichomes 0.5–1 mm. long, tipped with yellowish or translucent glands, and often with an inconspicuous underlying pubescence of short, curved, whitish, non-glandular trichomes; sepals 6–10 mm. long, oval, glandular-villosulous, the mucro 0.5–1.5 mm. long; petals emarginate, 1.2–1.5 cm. long, pale to deep rose-purple, pilose about one-fourth their length; mature stylar column 1.5–3 cm. long, densely glandular-pubescent; stylodia 5–6 mm. long; carpel-bodies 4–5 mm. long, hispid with trichomes 1–2 mm. long; seeds 3–3.5 mm. long, reticulate.—Cat. N. Am. Pl. ed. 2. 7 (1900); Hanks & Small in N. Am. Fl. xxv. 14 (1907); Coulter & Nelson, New Man. Rocky Mt. Bot. 303 (1909); Knuth in Engler, Pflanzenr. iv (129) 100 (1912); Rydberg, Fl. Rocky Mts. 532 (1917). *Geranium Fremontii* var. *Parryi* Engelm. in Am. Journ. Sci. ser. 2. xxxiii. 45 (1862). *Geranium Richardsonii* var. *intermedia* O. Kuntze, Rev. Gen. Pl. i. 93. 1891. *Geranium Pattersonii* Rydberg, Bull. Torr. Bot. Club, xxix. 242 (1902); Hanks & Small in N. Am. Fl. xxv. 14 (1907); Knuth in Engler, Pflanzenr. iv (129). 100 (1912); Rydberg, Fl. Rocky Mts. 532 (1917). *Geranium Fremontii Parryi* Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941).—Not uncommon on gravelly slopes or in rocky soil, on mountainsides, in canyons, or foothills, at altitudes of 7000 to 10,000 feet, southern Wyoming, Colorado, Utah, and Arizona. TYPE LOCALITY: "From the headwaters of Clear Creek, and the alpine ridges lying east of 'Middle Park', Colorado Territory." TYPE collected in 1861 by C. C. Parry. Specimens examined: WYOMING: Jelm, Albany Co., *Aven Nelson* 8061 (G, NY). COLORADO: Colorado Springs, *M. E. Jones* 150 (NY); Broadmoor, *A. Isabel Mulford*, Sept. 1, 1892 (NY); Pike's Peak, *T. F. Allen* in 1894 (NY); Manitou, *F. Clements* 187 (NY); Idaho Springs, *C. L. Shear* 3282 (NY); Rollinsville, *L. O. Overholtz*, July 8, 1913 (NY); Watertown, Douglas Co., *Osterhout & Clokey* 4196 (NY, F, UC); Gray's Peak, *P. A. Rydberg*, Aug. 23, 1895 (NY, type of *G. Pattersonii* Rydb.); North Cheyenne Canyon, near Pike's Peak, *E. A. Bessey*, July 14, 1896 (NY); foot of Pike's Peak, *C. L. Shear* 3702 (NY); Ute Pass, *C. L. Shear* 3696 (NY); Eldora to Baltimore, Gilpin Co., *F. Tweedy* 5537 (NY); no definite locality, *Herb. Otto Kuntze* 3024 (NY); Buffalo Creek Canyon, *H. H. Rusby*, Sept. 14, 1909 (NY); near Empire, *H. N. Patterson* 176, 177, (NY, G, F, UC); headwaters of Clear Creek east of Middle Park, *C. C. Parry* 113 (TYPE, NY; G); Artist's Glen. Pike's Peak, *H. M. Hall* 10927 (UC, G); Brookvale, Clear Creek Co., *J. R. Churchill*, June 19, 1918 (G); mts. of Colorado, *W. M. Canby*, Aug. 1871 (G); Larkspur, Arapahoe Co., *R. C. Rollins* 1194 (UI, G); Crescent, Gilpin Co., *H. M. Hall* 10425 (UC); Sierra Mojado, *T. S. Brandegee*, June 22, 1877 (UC); Trails End, *Aven Nelson* 10112 (UC). UTAH: near Mirror Lake, Kane Co., *W. S.*

Boyle Z375 (UC). ARIZONA: Clark's Valley, *H. H. Rusby*, Aug. 4, 1883 (NY); Trumbull, *E. Palmer* 68 (G).

This species has an obvious affinity with *G. Fremontii* and by some authors has been regarded as a variety of it. It may be distinguished at once from *G. Fremontii* by the glandular-villous indument of the stem and petioles, while the stem and petioles of *G. Fremontii* are short-pubescent, with non-glandular trichomes.

We are reducing *G. Pattersonii* to synonomy under this species because it occupies the same geographical range and habitat, and we can find no reliable taxonomic characters to distinguish it. The leaf-characters used originally to separate *G. Pattersonii* from *G. Parryi* are intangible and inconstant. However, it may be worth noting that the pubescence of the petioles of the basal leaves, and the lower internode of the stems of some of the specimens determined by Rydberg as *G. Pattersonii* is somewhat less glandular than in most specimens of *G. Parryi*.

14. G. FREMONTII Torr. ex Gray. Perennial with branched caudex; stems 20–50 cm. tall, tufted, erect at first, later decumbent and divaricately branched, the lower internode sparsely retrorsely strigose to nearly glabrous; petioles of the basal leaves 7–30 cm. long, finely retrorsely pubescent with whitish, glandless trichomes; blades 3–8 cm. broad, reniform to pentagonal, 5–7-parted, the lobes oblong, acute, strongly veined, sparsely appressed-pubescent on both surfaces, or sometimes glandular below; cauline leaves similar, smaller, the petioles glandular-pubescent, as are frequently the uppermost leaves; blades 2–5 cm. broad, 3–5-parted; stipules lanceolate, 5–7 mm. long, puberulent, more or less glandular, ciliate; inflorescence axillary or terminal; peduncles 1.5–3 cm. long; pedicels in pairs (rarely more than 2), usually 2–3 cm. long, rather densely glandular-villosulous, the trichomes short, spreading, yellowish-tipped; sepals 7–12 mm. long, oval-lanceolate, the mucro 1 mm. long, the outer ones glandular; petals 1–1.5 cm. long, obovate, emarginate, pale purple, dark-veined, rarely white, pilose about one-fourth their length; filaments ciliate one-fourth their length; mature stylar column about 3 cm. long, densely glandular-pubescent; stylodia 4–5 mm. long; carpel-bodies 5 mm. long, sparingly pubescent or hispid, at least along the keel, the trichomes about 1 mm. long; seeds 3–4 mm. long, reticulate.—In Pl. Fendler. [Mem. Am. Acad. ser. 2. iv.] 26 (1849); Engelmann in Gray, op. cit., 27 (1849); Trelease in Mem. Boston Soc. Nat. Hist. iv. 75 (1888), and in Gray, Syn. Fl. i. 359 (1897); Howell,

Fl. Nw. Am. 106 (1897); Hanks & Small, N. Am. Fl. xxv. 15 (1907); Coulter & Nelson, New Man. Rocky Mt. Bot. 303 (1909); Knuth in Engler, Pflanzenr. iv (129). 101 (1912); Wooton & Standley, Contr. U. S. Nat. Herb. xix. 381 (1915); Rydberg, Fl. Rocky Mts., 532 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 338 (1925); Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941). *Geranium furcatum* sensu Hanks in Hanks & Small, N. Am. Fl. xxv. 16 (1907); Knuth in Engler, Pflanzenr. iv (129). 104 (1912); Wooton & Standley, Contr. U. S. Nat. Herb. xix. 381 (1915). Non Kit. in Linnaea, xxxii. 567 (1863), nec Schur, Enum. Pl. Transs. 138 (1866). *Geranium caespitosum* sensu Hanks & Small, in N. Am. Fl. xxv. 15 (1907); Rydberg, Fl. Rocky Mts., 532 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 337 (1925). Non Gray (1849). *Geranium caespitosum gracile* Nels. & Macbride, Bot. Gaz. lv. 376 (1913); *Geranium atropurpureum* var. *furcatum* Kearney & Peebles, Journ. Washington Acad. Sci. xxix. 485 (1939).—Canyons, plains, and foothills, 5000–10000 feet altitude, in Wyoming, Colorado, New Mexico and Arizona. TYPE LOCALITY: "Bottom lands of the Mora River, among shrubs; August. (Also in the Raton Mountains, *Lieut. Abert*, and probably farther north and west by Col. Fremont.)." Representative specimens: WYOMING: Camp Crawford, *Mrs. Joseph Clemens*, Aug. 6, 1908 (G, F); Chug Creek, Albany Co., *Aven Nelson* 7330 (NY, G, UI); Albany, *W. G. Solheim* 242 (UI); Laramie, *B. C. Buffum*, June 1892 (UI). UTAH: Willow Springs, *E. H. Graham* 9563 (G); Bryce Canyon, *W. S. Boyle* Z392 (UC); Panguitch Lake, *Goodman & Hitchcock* 1587 (NY, US, F, G, UC). COLORADO: Sangre de Christo Creek, *Rydberg & Vreeland* 5916 (NY); Sand Creek Pass, *C. F. Baker*, Aug. 3, 1897 (NY); Fort Collins, *C. S. Crandall*, July 15, 1897 (NY), *Mildred E. Mathias* 363 (NY), *G. E. Osterhout* 6315 (G), *C. F. Baker*, May 24, 1896 (NY); Wooton, *H. H. Rusby*, Sept. 11, 1909 (NY); Gunnison, *R. C. Rollins* 1333 (NY, UI); Twin Lakes, *I. W. Clokey* 3584 (NY, G, UI, UC); Allenspark, *Johnston & Hedgecock* 724 (NY); Thompson Canyon, *E. L. Johnston* 704 (NY); Boulder, *F. Tweedy* 5017 (NY); Sheep Canyon, *F. E. & Edith S. Clements* 90 (NY, G); Larimer Co., *J. H. Cowen* 99 (UC, NY), 112 (G), *G. E. Osterhout* 6312 (UC, G); Estes Park, *Mrs. R. L. Russell* in 1916 (G); La Veta, *C. S. Crandall*, Aug. 21, 1897 (NY); Gould Creek, Pike's Peak Forest Reserve, *J. C. Blumer*, Aug. 12, 1903 (G, F); North Elk Canyon, Rio Blanco Co., *W. C. Sturgis*, July 21, 1902 (G); Low Mts., n. Colorado, *Asa Gray* in 1872 (G); Como, *Miss E. L. Hughes* 47, 48 (G); Estes Park, *M. S. Baker* 4515b (UC). NEW MEXICO: Ceballa, *E. O. Wooton* 2875 (NY); Pinos Altos Mts., *E. L. Greene*, Aug. 23, 1880 (F); without definite locality, *Frémont* 42 (NY, G); Raton Mts., *Abert*, Aug. 7, 1846 (NY, TYPE; G). ARIZONA:

Flagstaff, *C. A. Purpus* 8096 (UC); Bekins Butte, *J. W. Toumey*, July 19, 1892 (UC); White Mts., *L. N. Goodding* 655 (NY); San Francisco Mt., *C. B. Wolf* 3165 (G); Grand Canyon of the Colorado, *T. F. Allen*, Aug. 1897 (NY, type of *G. furcatum* Hanks; UC).

Geranium Fremontii is a characteristic plant of hillsides and canyons of the southern Rocky Mountain region. It has been named by several authors *G. caespitosum*, but as shown in the discussion in this paper, following the description of *G. caespitosum* James, this is, of course, quite erroneous. *G. Fremontii* is much closer to *G. Parryi* than it is to *G. caespitosum*.

Geranium furcatum Hanks, described from specimens collected in the Grand Canyon of the Colorado, is evidently identical with *G. Fremontii*, and is therefore herein reduced to synonomy.

15. G. EREMOPHILUM Wooton & Standley. Perennial with a slender, branched caudex; stems tufted, slender, weak, divaricately branching, suberect or decumbent, 40–70 cm. long, finely retrorsely pubescent; petioles of the basal leaves 4–6 cm. long, finely retrorsely pubescent, the blades 2.5–4 cm. broad, pentagonal in outline, obtuse or truncate at the base, 3- or 5-lobed, the lobes rhombic, 3-toothed, acute, finely appressed-pubescent; cauline leaves smaller, thin, 3-lobed, generally halberd-shaped, sparingly appressed-pubescent above, the lower surface similar except for more or less retrorse pubescence on the veins; stipules attenuate-lanceolate, 2–10 mm. long, puberulent, ciliate; peduncles axillary, slender, 3–15 cm. long; pedicels paired, finely retrorsely pubescent and sometimes somewhat glandular, 1.5–3 cm. long; sepals 8–10 mm. long, oval-lanceolate, appressed-pubescent, not glandular, the mucro 1–2 mm. long; petals purplish pink, 1–1.5 cm. long, obovate, retuse, sometimes paler, pilose about half their length; mature stylar column 2.5–3 cm. long, appressed-pubescent or glandular-pubescent; stylodia 6–7 mm. long; carpel-bodies 4–5 mm. long, sparingly short-strigose; seeds about 3 mm. long, reticulate.—Wooton & Standley in Contr. U. S. Nat. Herb. xvi. 142 (1913).—Mountains of New Mexico and Arizona. TYPE LOCALITY: San Luis Mountains, New Mexico. Specimens examined: NEW MEXICO: San Luis Mts., *E. A. Mearns* 2142 (US, TYPE), 2194 (US); Redstone, *A. Isabel Mulford* 859 (NY); Fort Bayard Watershed, Grant Co., *J. C. Blumer* 29 (NY, G); Hot Springs, *F. H. Snow* (UC); Mogollon Mts., Socorro Co., *O. B. Metcalfe* 242 (NY); Organ Mts., Dona Ana Co., *Wooton & Standley*, Sept. 23, 1906 (US). ARIZONA: Luka-Chukai Mts., Apache Co., *Goodman & Lois B. Payson* 2785 (NY); White Mts., *L. N. Goodding* 1248 (NY); Flagstaff, *H. C. Hanson* A 194 (UI); Barnhart Pass, Matzatzal

Mts., Gila Co., *Rose E. Collom* 111 (NY); Chiricahua Mts., *J. W. Toumey* (G); Rincon Mts., *J. C. Blumer* 3305 (UC); Huachuca Mts., *L. N. Goodding* 356 (NY), *E. A. Mearns* 2601 (US); Apache Pass, *J. G. Lemmon* 524 (G).

This species is most closely related to *G. caespitosum*, from which it differs in having more or less glandular indument, at least on the pedicels. In discussing the relationship of *G. eremophilum* with its near allies, Wooton & Standley say ". . . near *G. Fremontii* and *G. caespitosum*, but is more slender, has paler, rather larger flowers, scarcely any glandular pubescence, and nearly glabrous leaves with broader, blunter segments." This analysis is amply supported by a close study of the holotype and abundant additional specimens from Arizona and New Mexico.

16. G. CAESPITOSUM James. Perennial with a woody, usually branched caudex; stems tufted, erect at first, later becoming procumbent or ascending, divaricately branched, and frequently rooting at the nodes, 10–90 cm. long, strigillose to pilosulous with glandless trichomes above, often rather copiously short-villous near base; petioles of the basal leaves 8–12 cm. long, pubescent; blades 2–5 cm. broad, orbicular to pentagonal in outline, finely appressed-pubescent on both surfaces, 5-parted, the lobes rhombic, each 3-parted; basal sinus broad, open; cauline leaves similar, 1–5 cm. broad, 3–5-parted, the 3-divided lobes divaricate, acute; stipules linear-lanceolate, acuminate, 2–10 mm. long, puberulent and ciliate; peduncles solitary, axillary, slender, pilosulous, 4–15 cm. long; pedicels paired, 2–3 cm. long, becoming reflexed in fruit, retrorsely pilosulous or puberulent with non-glandular trichomes; sepals 8–12 mm. long, oval, 3-veined, acute or obtuse, hyaline-margined, ciliate and sparsely appressed-pubescent, non-glandular; mucro 1–2 mm. long; petals 12–18 mm. long, obovate, deep rose-purple, sometimes paler, pilose inside about half their length; mature stylar column 2.5–3 cm. long, sparsely puberulent; stylodia 5–8 mm. long; carpel-bodies 4–5 mm. long, sparsely short-strigose, with an underlying puberulence; seeds 3–4 mm. long, reticulate.—James apud Gray, Plantae Fendl. [Mem. Am. Acad. ser. 2. iv.] 25 (1849); James in Long's Exped. Rocky Mts. ii. 3 (1823), as "*G. caespitose*"; Torr. in Ann. Lyceum Nat. Hist. New York, ii. 173 (1828); Torr. & Gray, Fl. N. Am. i. 207 (1838); Walpers, Rep. Bot. Syst. i. 450 (1842); Engelm. in Gray, Mem. Am. Acad. ser. 2, iv. 27 (1849), in Plantae Wright. ii. 25 (1852); Trelease in Mem. Boston Soc. Nat. Hist. iv. 75 (1888), and in Gray, Syn. Fl. i. 359 (1897); Coulter & Nelson, New Man. Rocky Mt. Bot. 303 (1909); Knuth in Engler, Pflanzenr. iv (129). 102 (1912). *Geranium gracile* sensu Engelm. in Gray, Mem. Am. Acad. n. s. iv. 27

(1849); Hanks & Small in N. Am. Fl. xxv. 16 (1907); Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941). Non Ledeb. ex Nordm. in Bull. Sc. Acad. St. Petersb. ii. 314 (1837), nec Schrenk in Bull. Phys. Math. Acad. St. Petersb. iii. 308 (1845). *Geranium caespitosum* f. *albiflorum* Cockerell, Science Gossip, xxv. 188 (1899). *Geranium atropurpureum* Heller, Bull. Torr. Club, xxv. 195 (1898); Knuth in Engler, Pflanzenr. iv (129). 103 (1912); Wooton & Standley, Contr. U. S. Nat. Herb. xix. 380 (1915); Rydberg, Fl. Rocky Mts. 533 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 337 (1925).—Hillsides, canyons, or open woods, Colorado and western Texas to New Mexico, Arizona, and Utah; Mexico. Type Locality: "Santa Fé Creek, near irrigating ditches, at the foot of mountains; May to July; and six miles east of the Mora River; August."—Representative specimens: Colorado: Norwood Hill, San Miguel Co., *E. P. Walker* 407 (NY, G); Artist's Glen, Minnehaha, *J. Arthur Harris* C21409 (NY); Beaver Creek Reservoir, Rio Grande Co., *R. C. Rollins* 1491 (NY, G, UI); Rio Blanco Creek, Archuleta Co., *R. C. Rollins* 1543 (NY, G, UI); Ouray, *Underwood & Selby* 152, 152a (NY), *C. F. Baker* 763 (NY, G); Arboles, *C. F. Baker* 448 (NY, F, G); Paradox, Montrose Co., *E. P. Walker* 217 (G); Pagosa Springs, *Susan Delano McKelvey* 4716 (G); Dolores, Montezuma Co., *C. S. Crandall* 111 (G); Pueblo, *R. W. Woodward*, June 1883 (G); Horsefly Creek, Montrose Co., *E. B. & Lois B. Payson* 3908 (G, UC); Mancos, *Baker, Earl & Tracy* 407 (F, NY, G, UC). Texas: McKittrick Canyon, Guadalupe Mts., Culberson Co., *Moore & Steyermark* 3486 (NY, UC, G); Limpia Canyon, *G. C. Nealley* 65 (F); Livermore Peak, Davis Mts., Jeff Davis Co., *Ferris & Duncan* 2550 (NY), *E. J. Palmer* 30730A, 34371 (NY), *Mary S. Young*, September 10, 1918 (G, UC, UI). New Mexico: Santa Fé, *A. A. & E. Gertrude Heller* 3723 (NY, G, UI, type collection of *G. atropurpureum* Heller), *F. S. Earle* 81 (NY); Fort Bayard, *A. Isabel Mulford* 358 (NY, UI); Pinos Altos Mts., *A. Isabel Mulford* 760 (NY, UI); Whitman's Camp, *A. Isabel Mulford* 1243 (NY, UI); Cloudcroft, Sacramento Mts., Otero Co., *E. O. Wooton* 6753 (NY, G); Wheeler's Ranch, *E. O. Wooton*, July 11, 1906 (NY); White Mountain Peak, *E. O. Wooton*, July 6, 1895 (NY); Bartlett Ranch, *E. O. Wooton*, Sept. 3, 1913 (NY); White Mountains, Lincoln Co., *E. O. Wooton* 218 (NY, UC, UI); Burro Mts., *J. C. Blumer* 1835 (NY, F, G), Grant Co., *O. B. Metcalfe* 194 (NY, G, UI, UC); Copper Mines, *Thurber* 229 (NY, G); Las Vegas Hot Springs, *T. D. A. Cockerell* 58 (NY); Pecos River National Forest, *P. C. Standley* 4117 (NY, G); Ute Park, Colfax Co., *P. C. Standley* 14119 (NY); Trujillo Canyon, Gila Nat. Forest, *W. R. Chapline* 330 (NY); Balsam Park, Sandia Mountains, *Charlotte C. Ellis* 109 (NY); El Capitan Mts., *F. S. & Esther S. Earle* 201 (NY, UC); San Antonita, *J. M.*

Bigelow, Oct. 9, 1853 (NY, G); without locality, *C. Wright* 910 (NY, G); 6 mi. e. of Moro River, *A. Fendler* 89 (G, TYPE; NY, UC, F); Jemez Mts., Sandoval Co., *R. Goodwin*, Aug. 22, 1932 (G); High Rolls, Otero Co., *H. L. Viereck*, May, 1902 (G); Rociada, *J. E. Dandelin*, Aug. 1905 (G, UC); Rio Apache, *E. O. Wooton*, June 21, 1892 (UI). ARIZONA: Flagstaff, *L. F. Ward*, June 6, 1901 (NY), *D. T. MacDougal* 118 (NY, F, UC, G); Fossil Creek, *E. A. Mearns*, June 19, 1885 (NY); Pinedale, *Myrtle Zuck*, July 15, 1897 (NY); Santa Catalina, *J. A. Harris* C16392 (NY); Santa Catalina Mts., *C. G. Pringle* in 1881 (G); McNary, White Mts., *Goodman & C. L. Hitchcock* 1328 (NY, UC, G); Baboquivari Mts., *M. F. Gilman* 21 (NY); Painted Desert, Laguna Canyon, *W. N. Clute* 30 (NY, G, UI); Huachuca Mts., *L. N. Goodding* 776 (NY, G), *Lemmon* 2652 (G); Rincon Mts., *J. C. Blumer* 3305 (F, G); Coconino Nat. Forest, *G. A. Pearson* 298 (G); Mingus Mt., *W. W. Jones* 283 (G, UC). UTAH: Between Moab and Monticello, *Rydberg & Garrett* 9107 (NY); Monticello, *Rydberg & Garrett* 9163 (NY).

Because the publication in 1823 of this specific name by Dr. Edwin James was ambiguous, and since he had collected no specimen, the exact identity of James' plant is uncertain. All that James said about it is as follows: "*G. caespitose*, sub-erect, pubescent, sparingly branched above. Radical leaves reniform deeply 5–7-cleft. The flower is a little larger than that of *G. robertianum*, and similarly coloured, having whitish lines towards the base of the corrolla." When, in 1849 Gray described a species of geranium from the Rocky Mountains, he said, ". . . I am so confident that it is the species noticed and imperfectly characterized by Dr. James, that I venture to revive his name, which, unless thus identified, must ever remain appended to the genus as a doubtful species, since no specimens of it exist in the collections made by him in Long's Expedition." By this statement, and through the description of the species and the designation of a type locality, Dr. Gray appears to have securely established the entity *G. caespitosum* upon a firm and durable taxonomic foundation. Supporting evidence is supplied by a sheet in the Gray Herbarium, labeled Plantae Novo-Mexicanae, 6 miles east of Moro River, 18 Aug. 1847, *A. Fendler* 89, inscribed by Dr. Gray: "*G. caespitosum* James." Duplicate specimens are in the herbaria of the New York Botanical Garden and the University of California. However, dissenting opinion has been expressed by Trelease (1888) who makes this comment: "There is reason

to doubt whether James' plant was not really the preceding [i. e., *G. Fremontii*], for he did not collect south of Pike's Peak, while this species, as I understand it, is distinctively southern." It should be noted, however, that *G. caespitosum* ranges from New Mexico northward to Colorado and hence may occur in the region explored by James. A. A. Heller (1898) likewise expressed doubt as to the possibility that Gray's *G. caespitosum* could have been the plant observed in 1823 by James. The whole matter now appears to be rather inconsequential, because whatever may have been the identity of the plant observed by James, the fact remains that the name *G. caespitosum* was validated when Asa Gray gave it a proper description. It seems desirable therefore, to abide by Dr. Gray's interpretation. In fact, this conclusion was reached by Nelson & Macbride in 1913. They say[1]: "It is somewhat singular that there should be any misunderstanding in regard to *Geranium caespitosum* James. Admitting that the original printing of the name did not publish the species, Dr. Gray's diagnosis in Pl. Fendl. 25 and Dr. Trelease's in Bost. Soc. Nat. Hist. **4**: 72 fixed the plant to which this name must apply. Specimens answering to this description are not rare in the herbaria and are always non-glandular and with the pubescence of the stem (whether sparse or abundant) more or less retrorse. The plant is always cespitose, growing in the form of a turf or mat from which short assurgent stems arise. The new characterization in the N. A. Fl. **25**: 15 would seem to be without warrant, and at best that description presents merely one of the variants of *G. Fremontii* Torr."

The Fendler specimen of *G. caespitosum* named by Gray is identical with the plant later described by Heller as *G. atropurpureum*, and there are numerous additional specimens from Arizona, Colorado, and New Mexico to match it.

Hanks & Small, and later Rydberg, applied the name *G. caespitosum* to a coarser, glandular-pubescent plant, which they attempted to segregate from *G. Fremontii* because of slight differences in foliar characters; but we now know that *G. caespitosum* sensu Hanks & Small is synonymous with *G. Fremontii*. Hanks & Small, as well as Rydberg, applied the name *G. atropurpureum* Heller to the slender non-glandular plant which is the true *G. caespitosum*.

[1] Nelson, A., & Macbride, J. Francis, Bot. Gaz. lv. 376 (1913).

Examination of a series of specimens shows that plants with pale petals often occur in this species, as well as the apparently more common deep purple-flowered form described by Heller as *G. atropurpureum.* The varying amounts of anthocyanin pigment in the petals are correlated, in all probability, with the metabolism of the plant. Hanks & Small (1907) called this species *G. gracile* Engelm.; but this name is untenable because it was previously used by Ledebour in 1837, and again by Schrenk in 1845.

17. G. LENTUM Wooton & Standley. Perennial, with a stout caudex; stems 20–60 cm. tall, slender, ascending or spreading, copiously glandular-pilose; petioles of the basal leaves 7–13 cm. long, glandular-pilose; blades 3–5 cm. broad, roundish in outline, 5-parted, the divisions rhombic to obovate, and with obtuse tips, densely hispidulous-strigose or glandular-villosulous on both surfaces; cauline leaves similar, 2–5 cm. broad; stipules lanceolate, attenuate, 3–7 mm. long, pilose; inflorescence axillary and terminal, cymose; peduncles 2–7 cm. long, densely glandular-villosulous; pedicels paired, 1–4 cm. long, densely glandular-villosulous; sepals oval, 7–8 mm. long, the outer ones glandular-pilose; mucro 0.5–1 mm. long; petals 8–10 mm. long, white, entire or emarginate, sparsely pilose about half their length; filaments ciliolate half their length; mature stylar column 2–2.5 cm. long, glandular-pubescent; stylodia 4–5 mm. long; carpel-bodies about 4 mm. long, puberulent and sparsely hispid; seeds 2.5–3 mm. long, finely reticulate.—In Contr. U. S. Nat. Herb. xvi. 142 (1913); Tidestrom & Kittell, Fl. Ariz. & New Mex., 131 (1941), ex p.—Mountains of Arizona, New Mexico, and adjacent Texas; Mexico. TYPE LOCALITY: West Fork of the Gila River, Mogollon Mts., Socorro Co., New Mexico. Specimens examined: ARIZONA: Johnsons Basin, *E. O. Wooton,* June 22, 1892 (UI). NEW MEXICO: West Fork of Gila, Mogollon Mts., *E. O. Wooton,* Aug. 7, 1900 (US, TYPE); Tortugas Mt., southeast of Las Cruces, Dona Ana Co., *E. O. Wooton,* Oct. 6, 1904 (US); Middle Fork of the Gila, Mogollon Mts., Socorro Co., *E. O. Wooton,* Aug. 5, 1900 (US); Rio Zuni, *E. O. Wooton,* July 28, 1892 (US); Craters, Valencia Co., *E. O. Wooton,* July 28, 1906 (US); Pinos Altos Mts., *E. L. Greene,* September 1880 (F). TEXAS: Chisos Mts., *C. H. Mueller* 8050 (F).

Tidestrom & Kittell (1941) have placed the name *G. lentum* in synonomy under *G. Wislizeni;* however, we regard *G. lentum* as a distinct species, growing in New Mexico and Arizona, and probably also in Mexico, although we have seen no specimens of it from the region south of the Rio Grande. *G. lentum* is easily recognized by its densely glandular-villous indument on the

stems and leaves. It is readily separated from *G. Wislizeni* by its heavy indument, larger sepals and carpel-bodies, as well as the longer stylar columns and stylodia.

Geranium lentum may be more closely allied to the Section *Caespitosa* than to the Section *Mexicana*, and except for a more diffuse habit of growth, the solitary peduncles, white flowers, and more southern geographical range, it might be mistaken for *G. Parryi*, of the Colorado uplands, which has an erect habit, and lavender flowers.

18. G. WISLIZENI S. Wats. Perennial, the caudex usually simple; stems 20–40 cm. tall, often tufted, erect, retrorsely villosulous, not glandular, petioles of basal leaves 15–30 cm. long, villosulous; blades 2–8 cm. broad, pentagonal in outline, 5-parted, the rhombic lobes several times incised, the segments obtuse or rounded, sparsely strigose on both surfaces; basal sinus broad, obtuse; cauline leaves 3–5-parted, similar to the basal ones; stipules lanceolate, 3–7 mm. long, puberulent, ciliate; inflorescence spreading-cymose, the peduncles 1.5–6 cm. long; these, as well as the pedicels, pilose and more or less glandular; pedicels 0.5–2 cm. long, paired, spreading and reflexed in fruit; sepals 5–7 mm. long, oval, puberulent and sparsely hispidulous, the mucro 1–1.5 mm. long; petals 7–10 mm. long, entire, white, pilose one-third to one-half their length; filaments ciliate about three quarters their length; mature stylar column 1.4–1.8 cm. long, puberulent, more or less glandular; stylodia 2–3 mm. long; carpel-bodies 2–2.5 mm. long; mature seeds not seen.—Proc. Am. Acad. xxi. 421 (1886); Hanks & Small, N. Am. Fl. xxv. 11 (1907); Knuth in Engler, Pflanzenr. iv (129). 198 (1912); Tidestrom & Kittell, Fl. Ariz. & New Mex. 131 (1941), ex p.—Northern Mexico, Arizona, Texas.—TYPE LOCALITY: Norogachi, Mexico. ARIZONA: Sycamore Canyon, near Ruby, Santa Cruz Co., *Kearney & Peebles* 14434 (US); Huachuca Mts., *Peebles, Harrison & Kearney* 3506 (US), *L. N. Goodding* 729 (NY, G, US), *M. E. Jones* 24983 (G, NY), *J. G. Lemmon* 2651 (G). TEXAS: Mt. Livermore, *L. C. Hinckley* 404 (F).

This Mexican species extends northward into Arizona, and is represented in herbaria by a number of collections from the Huachuca Mountains. We have not attempted to study the type of *G. Wislizeni* which is in the Gray Herbarium but are using the interpretation made by T. H. Kearney who has written the following annotation attached to a sheet of *Peebles, Harrison & Kearney* 3506 (US). "*Geranium Wislizeni* Wats. ✱3506 corresponds well with the type in Gray Herb. (*Wislizenus* ✱211)

although Small in N. Am. Fl. does not give *Wislizeni* as occurring in U. S. Is probably the same plant referred by Trelease in Syn. Fl. N. Am. to *G. mexicanum* HBK. and stated to have been collected by Lemmon in the Huachuca Mts. True mexicanum appears, however, to be annual or at most biennial, and probably does not reach the U. S. Flowering specimens desired. T. H. K." As far as we know, no specimens of *G. mexicanum* have been collected in the United States.

Geranium Wislizeni is clearly distinguishable from *G. lentum* by its smaller and more delicate, cymose inflorescence, small sepals, and shorter stylar columns; also by the general lack of glandularity on the stems and leaves.

Department of Botany,
University of Illinois,
Urbana, Illinois.

REDISCOVERY OF CALTHA NATANS IN MINNESOTA

Olga Lakela

A hitherto unknown station of *Caltha natans* Pall. in Minnesota was discovered by the writer on August 4, 1942, at Deep Lake, Sparta. It is situated at the mouth of the inlet creek of Deep Lake. A recent sinking of the water level of the lake caused by a reclamation of a water-filled mine at Gilbert, 1.5 miles distant, left the creek bed nearly dry and about fifteen feet above the present shore line. The plants in the surviving colony were found growing in the eroding sand of the creek bed, creeping toward moisture. Among the larger plants in flower and fruit were young seedlings. Some of the seedlings were also observed on the lake shore, among those of *Alisma*, *Bidens* and *Sagittaria* spp. Obviously the seedlings had developed from germination of seeds washed down in the sediment from the colony established in the creek bed.

C. natans was first known in Minnesota about fifty years ago. The earliest collection was made by E. J. Hill at Tower on August 21, 1889. Two years later J. H. Sandberg encountered the species at "Vermillion". The place name on Dr. Sandberg's collections obviously refers to Lake Vermilion. Due to insuffi-

cient data on herbarium labels it is not clear whether or not the cited collections were made in the same locality. Tower is situated on Lake Vermilion, and the species was collected again at Tower in 1904 and 1905 by H. L. Lyon.

During the last forty years *C. natans* seems to have disappeared from its first known localities in Minnesota. Repeated efforts to find it in the Tower and Lake Vermilion area have failed. Equally futile have been the attempts to locate it on certain Canadian border lakes in Lake County where it reportedly occurs. Therefore, it was not altogether without surprise that the writer learned from Dr. N. C. Fassett of the finding of *C. natans* at Foxboro, Wisconsin as late as 1917. On July 4, 1942, the writer located the Foxboro colony in a partly filled-in *Typha-Salix* swamp on Great Northern Railroad tracks about one mile from the Foxboro station and the same distance from Minnesota state line. However, a later study of the area revealed that the site of the main colony is in the creek about half a mile north of the tracks. The creek crosses the tracks through a culvert, flows through a cultivated field into a forest where its channel, obstructed by fallen trees, forms sizable ponds. In these ponds *C. natans* is well established.

The range of distribution of *C. natans* is restricted to subarctic and north temperate regions of Eurasia and western North America. From the 60th° E. meridian west of the Ural Mountains through Siberia and Alaska to 92.5° W. meridian in Minnesota, the species more than half encircles the globe. Latitudinally its range on each continent extends from the arctic circle to about the 45th° N. parallel.

In Europe the species is known from Perm Province, 58° N. latitude, in Russia. In Siberia the range extends from Vilju District, 68° N. latitude to Manchuria and Spassk Province on 45th° N. parallel. Several collections have been made in the Transbaikal region and in the upper Amur and Lena River basins. The species also occurs in north and west Kamtchatka.

In North America *C. natans* occurs in isolated colonies from the coast of Alaska to the center of the continent. The northernmost station where the plant has been collected is at Circle Hot Springs. It is encountered at Fairbanks and Nome. From Alaska its range extends through Tupper Creek, British Colum-

bia, to Alberta with several collections from Athabasca, Peace River and Lesser Slave District. Leaving Edmonton, the next known station is at Ingolf, Ontario, about 20 miles north of the Northwest Angle of Minnesota; thence to Tower,[1] Sparta and on to Foxboro, Wisconsin, at 46.5° N. latitude, the southernmost known station on the continent.

State Teachers College
Duluth, Minnesota

Scirpus Longii in North Carolina.—In 1911 I described from Burlington and Camden Counties, New Jersey, and from Norfolk County, Massachusetts, a very characteristic woolgrass, the distinctions of which had been already worked out by its discoverer, Mr. Bayard Long; a rather coarse species, differing at once from the northern and transcontinental *S. atrocinctus* Fern., in its glutinous or glandular involucre, large spikelets with long scales, long anthers, whitish and very long perianth-bristles and broad 3-angled reddish to castaneous achenes. This is *S. Longii* Fern. in Rhodora, xiii. 6 (1911). Subsequently localized colonies have been found in other counties of eastern Massachusetts, with isolated ones in central Connecticut and on Long Island; and in 1941 Weatherby[2] got it in Queens County, Nova Scotia, with *Lophiola septentrionalis* Fern., the Nova Scotian representative of the New Jersey *L. americana* (Pursh) Wood, and near the first station east of Cape Cod for the Coastal Plain *Lachnanthes tinctoria* (Walt.) Ell. *Scirpus Longii*, therefore, has shown itself to be an old Coastal Plain type which, like so many other species, became isolated in Nova Scotia before the late Tertiary or early Pleistocene submergence of the continental shelf.

Several of the distinctive plants of southern New Jersey or adjacent Delaware (such as *Panicum leucothrix* Nash, *Habenaria integra* (Nutt.) Spreng., *H. nivea* (Nutt.) Spreng., *Rhexia aristosa* Britt., *Lobelia Canbyi* Gray and *L. Boykinii* T. &. G.) are unknown between their northern area and the Coastal Plain of

[1] Tower, "Mich." in illustrated Flora, Britton and Brown, II: 52, 1897 is obviously an error. There are no collections from Michigan.

[2] See Weatherby, Rhodora, xliv. 232, 233 (1942).

North or South Carolina or in some cases of Georgia. It is, therefore, most interesting to find in the Gray Herbarium (distributed as the northern *Scirpus pedicellatus* Fern.) an over-ripe but characteristic specimen of *S. Longii* from wet sand bordering pond 1½ miles southeast of Kinston, Lenoir County, North Carolina, July 9, 1922 (overripe), *L. F. & Fannie R. Randolph*, no. 579.—M. L. FERNALD.

AN INVALUABLE REFERENCE WORK.—The *Geographical Guide to Floras of the World* by S. F. Blake and Alice C. Atwood[1] is bound to be one of the most valued and consulted bibliographies. Part I, covering Africa, Australia, North and South America and the Islands of the Atlantic, Pacific and Indian Oceans, has recently been issued. The work of the authors must have been tremendous and the discriminating between important and unimportant items a perplexing task. The result is 261 pages of closely printed lists of the more significant publications on the floras of the areas covered. There is no padding; in fact, areas where there are plenty of local lists and papers are represented by fewer minor citations than those which are shy on good local lists. This is as it should be. Those whose work concerns the less known regions are thankful for all references; those studying New York or Pennsylvania, for instance, can readily orient themselves without the lesser items. Economic interests are stressed, so that everyone who needs to get at the important floras of the regions covered, whether purely technical or more practical, is going to be more and more thankful to the authors and to the Department of Agriculture.—M. L. F.

[1] *Geographical Guide to the Floras of the World*, an Annotated List with special Reference to useful Plants and common Plant Names. Part I. Africa, North America, South America, and Islands of the Atlantic, Pacific, and Indian Oceans. By S. F. BLAKE and ALICE C. ATWOOD. U. S. Dept. Agric., Misc. Pub. no. 401. 335 pp. Government Printing Office, Washington, 1942. For sale by the Superintendent of Documents, Washington, D. C. Price 75 cents.

Volume 45, no. 529, including pages 1–28 and plate 745, was issued 16 January, 1943.

MAR 24 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. March, 1943. No. 531.

CONTENTS:

The Broad-leaved Species of Potamogeton of North America north of Mexico. *E. C. Ogden.* 57

The Seashore State Park, a Part of Cape Henry, Virginia. *Frank E. Egler.* 105

Development of a Leafy Axis upon the Cones of Tamarack. *George B. Rossbach.* 106

Note on "Fossil Evidence of wide Post-Pleistocene Range for Butternut and Hickory in Wisconsin." *Stanley A. Cain.* .. 107

The Perennial Helenium of the Edwards Plateau of Texas. *V. L. Cory.* 109

Two later Homonyms. *M. L. Fernald.* 111

The New England Botanical Club, Inc.

8 and 10 West King St., Lancaster, Pa.

Room 1001, 53 State St., Boston, Mass.

RHODORA.—**A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.**

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. A limited number of sets of past issues, composed partly of original cards and partly of photostatic copies, can be supplied.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

H plants-pre

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. March, 1943. No. 531.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXLVII

THE BROAD-LEAVED SPECIES OF POTAMOGETON OF NORTH AMERICA NORTH OF MEXICO

E. C. Ogden

(Plates 746–748)

The genus *Potamogeton* is of world-wide distribution. Because it exhibits a great range of environmental variation, and specimens so often lack the fundamental diagnostic parts which might ally them with already known entities, the names that have been coined for its members are legion.

Although a number of monographic treatments have dealt with the North American species in whole or in part[1], the broad-leaved groups have been poorly understood. The really usable treatment of the troublesome linear-leaved species by Fernald lent new hope to the idea that possibly the broad-leaved plants

[1] Thomas Morong, The Naiadaceae of North America, Mem. Torr. Club **3**: no. 2 (1893).

P. Ascherson and P. Graebner, in Engler, Pflanzenr. **4**: fam. 11. Potamogetonaceae (Potamogeton by Graebner) (1907).

Norman Taylor, in N. Am. Fl. **17**: pt. 1 (1909).

J. O. Hagström, Critical Researches on the Potamogetons, Kungl. Svenska Vetenskapsakad. Handl. **55**: no. 5 (1916).

Harold St. John, A Revision of the North American Species of Potamogeton of the Section Coleophylli, Rhodora, **18**: 121–138 (1916).

M. L. Fernald, The Linear-leaved North American Species of Potamogeton, Section Axillares, Mem. Amer. Acad. Arts & Sci. **17**: pt. 1 (1932). As this work contains an excellent discussion of the previous treatments, an historical introduction would merely be repetitive and is unnecessary here.

might be resolved into something approaching an expression of their true relationships.

A fertile *Potamogeton* seldom causes great difficulty; but the great mass of sterile material, displaying a range of form unknown in the fertile plants, has made an understanding of the group difficult. To add to the confusion, the broad-leaved species, with their spikes buoyed up above the water, hybridize more or less freely, rendering it difficult in many cases to determine the fundamental cause behind the abnormality.

The following treatment is offered in the hope that the species here considered may be better understood; and that specimens may be properly identified, even though they lack many of the important diagnostic characters and exhibit forms that are far from typical.

Diagnostic Characters

Fruits. When mature fruits are present there is seldom any difficulty in referring the specimen to the proper species. Unfortunately the presence of fruit is not the rule but the less common occurrence. Most distinctive are those of *P. alpinus*, with a smooth, hard, eggshell-like exocarp, tawny-olive in color; fruiting specimens can never be mistaken for any other species. Neither can the minute reddish orbicular fruits of *P. polygonifolius* with their beaks practically obsolete, nor the massive fruits of *P. praelongus* be confused with those of any other North American broad-leaved species. The long-beaked fruits of *P. crispus* are especially characteristic. Extremely important diagnostic characters are the prominence of keels and the color of the exocarp. If one makes a longitudinal section with a razor-blade, the amount of curvature of the seed becomes apparent and is of some slight diagnostic value. More important in some cases, and surprisingly consistent, is the presence or absence of a cavity in the endocarp tissue that projects as a fold into the center of the fruit. This projection (endocarp loop) is solid in all the broad-leaved species except *P. polygonifolius*, *P. praelongus* and *P. Richardsonii*. This is an important character in the separation of *P. Richardsonii* from *P. perfoliatus*, specimens of which often strongly resemble each other. Because the fruits are of great taxonomic importance, but difficult ade-

quately to describe, it has seemed desirable to illustrate them (see PLATE 746).

FLOWERS. It is now generally considered that *Potamogeton* has no true perianth. The sepal-like structures are thought to be outgrowths from the connectives of the stamens, and are called sepaloid connectives.[1] In the species here treated they are of little or no diagnostic value. Careful observations on the shape and hundreds of measurements on the width and length of claw have been made, from which it has become evident that even species which in most characters are strikingly different have sepaloid connectives which are surprisingly similar. The anthers, also, are of about the same shape and size in all the broad-leaved species, except that in *P. polygonifolius* they average somewhat smaller. Pollen-grains should be examined when hybridism is suspected. Fertile species have pollen-grains well formed and abundantly produced, whereas hybrids invariably have a large percentage aborted.

SPIKES. While the flowering spikes are of little diagnostic value, differing chiefly in average size and in number and degree of crowding of the whorls of flowers, the diameter of the fruiting spikes can be used. This thickness is almost entirely dependent on the length of the fruits, but in many cases the fruit-measurements cannot be so easily obtained. While there are some differences as to length of the spikes of different species, these are mostly a direct correlation with the robustness of the species, and their diagnostic value is therefore secondary.

PEDUNCLES. Characters of the peduncle can usually not be used for the determination of broad-leaved species without supporting characters from other parts of the plant, due to the great variation within the same species, but they are sometimes of useful supplementary value. Most species seldom have peduncles over 10 or 15 cm. long, but in *P. amplifolius* they may run up to 30 cm. and it can then be distinguished from *P. pulcher* or *P. nodosus*, which at times it may superficially resemble. Similarly, *P. Richardsonii* may have peduncles up to 25 cm. in length, in contrast to its nearest relative, *P. perfoliatus*, with peduncles less than 10 cm. long. The longest peduncles are

[1] Phylogenists are not agreed on this. These structures may well represent a norma perianth with the anthers sessile on the claws of the segments.

found on *P. praelongus*, where they are often more than 30 cm. and may attain a length of 60 cm. The three species mentioned as sometimes having long peduncles (*P. amplifolius*, *P. praelongus*, and *P. Richardsonii*) may also have them short; but whether long or short, usually with a tendency to be clavate. This tendency for the peduncles to be thickened upward is also somewhat characteristic of the subsection *Lucentes*. Most of the species here treated have their peduncles rather uniform in thickness throughout their length. Another character of slight value is the thickness of a peduncle in comparison with the thickness of the stem at the internode directly below. This has some supplementary value in the subsection *Natantes*, where *P. natans* has peduncles about the same thickness as the stem, while *P. Oakesianus*, with its slenderer stem, has less reduction in the thickness of its peduncles, and as a consequence has them thicker than the internode below. Lastly, there are some differences in their internal anatomy. These are, however, few and inconstant and not used in this treatment.

Stipules. In all of the species here treated (with the exception of *P. crispus*) the stipules are free from the leaves. They clasp the stem, but have their margins absolutely free and ununited. They are all obtuse, at least when young, but as there is often a tendency for them to be somewhat cucullate they may, at times, appear to be acutish. This is especially true of *P. nodosus*. All are more or less two-keeled (when mature) except in the subsections *Crispi*, *Colorati*, *Praelongi*, and *Perfoliati*. The chief differences are in their length and coarseness, which are, for the most part, rather direct correlations with the robustness of the species. They furnish useful characters in the perfoliate-leaved species where one can usually recognize *P. praelongus* by its large white stipules, *P. Richardsonii* by its stipules reduced to strong white fibers, and *P. perfoliatus* with stipules delicate and inconspicuous.

Leaves. Certainly some of the most important diagnostic characters for the identification of the broad-leaved species of *Potamogeton* are to be found in the leaves, for too often all that are available are stems and either submersed or floating leaves, or both. At least three fourths of the specimens in the herbaria lack not only mature fruits but any part of an inflorescence.

FRUITS OF POTAMOGETON, × 5

P. ALPINUS var. TENIFOLIUS, figs. 1–3; P. ALPINUS var. SUBELLIPTICUS, figs. 4–6; P. POLYGONIFOLIUS, figs. 7–9; P. AMPLIFOLIUS, figs. 10–13; P. PULCHER, figs. 14–17; P. NODOSUS, figs. 18–21; P. NATANS, figs. 22–25; P. OAKESIANUS, figs. 26–29; P. ILLINOENSIS, figs. 30–35; P. GRAMINEUS, figs. 36–38; P. PRAELONGUS, figs. 39 and 40; P. RICHARDSONII, figs. 41–46; P. PERFOLIATUS var. BUPLEUROIDES, figs. 47–50.

The stipules often shrivel and decay, so that the few remnants (if any are left) are insufficient for diagnostic purposes. Rhizomes are seldom collected and when present are of but slight taxonomic value. Thus, unless one resorts to the internal anatomy of the stem, it is, in the great majority of cases, necessary to determine the specimens from the leaves. These may be either submersed or floating, or both, in all the subsections except *Crispi*, *Praelongi*, and *Perfoliati*, which have only submersed leaves. These three subsections always have sessile perfoliate-clasping leaves[1] with broad bases in contradistinction to the other subsections which have their submersed leaves petioled or at least narrow at base.

First considering the submersed leaves: their shape is of primary importance. When typically developed, *P. perfoliatus* can be recognized immediately by its short-ovate leaves; *P. Richardsonii* by having them ovate-lanceolate; *P. praelongus* with them oblong and cucullate at the apex; the members of the *Lucentes* by the sharp-pointed apices; *P. natans* and *P. Oakesianus* by their coarse and delicate, narrowly linear leaves, respectively; *P. nodosus* by its long-petioled lanceolate leaves gradually tapering at both ends; *P. pulcher* having distinctive lanceolate leaves abruptly tapering to a petioled base; *P. amplifolius* with its massive leaves conspicuously arcuate; and *P. alpinus* with obtuse apex and sessile base. Unfortunately, however, it is not always as simple as that. These leaves exhibit such a wide range of variation[2] from the typical and are often in such a poor state of preservation, if not entirely absent, that one must resort to other parts of the plant for diagnostic characters. The leaf-margin of *P. crispus* is finely but evidently toothed; in the other broad-leaved species the leaf-margins are strictly entire, except in the *Nodosi*, which have 1-celled denticles so extremely fugacious as to be found only in the youngest leaves; the *Perfoliati*, in which the 1-celled denticles are more persistent; and the *Lucentes*, with strongly developed denticles. None of the indigenous North American species with free stipules has a dentation visible to the unaided eye, consequently they should

[1] The hybrid *P. gramineus* × *perfoliatus* var. *bupleuroides* may have perfoliate submersed leaves and also floating leaves.

[2] See discussion under VARIATION.

never be confused with *P. crispus*, a species naturalized from Europe, which has an evident serrulation.

Turning to the floating leaves, we find at first glance a discouraging similarity. With the exception of *P. alpinus*, which has delicate, lacunate floating leaves the blades of which taper without sharp distinction into the petiole, all seem to possess the common ovate-elliptic shape and have the same blunt mucro at the apex. When typically developed, however, we find some help in the bases of the blades. Their shape ranges from cordate in *P. natans* and *P. pulcher* to rounded in *P. Oakesianus* and *P. amplifolius* to cuneate in *P. nodosus* to tapering without sharp distinction into the petiole in *P. alpinus*. Yet, the range of variation is so great in any one species that the shape of the leaf-base must be used with caution. Even *P. natans* with its strongly cordate leaf-bases may under certain conditions have them narrowly cuneate.[1] The number of nerves is of primary importance in the case of *P. amplifolius*, which has them very numerous and close together. The size and shape of the stomates appear to be rather uniform, and while there is some variation as to the number in a given field, this appears to be influenced by factors which are ecological rather than genetic. Examination as to number and condition (whether functional or closed by cuticle) may be useful in determining whether the abnormality of some floating leaves is due to genetic or to ecological factors.

Stem. For a genus which varies so considerably due to ecological conditions, and which is so often found lacking parts that have the essential diagnostic characters, it is exceedingly fortunate that there are good characters in the anatomy of the stem. These were apparently first noticed and their importance realized by Raunkiaer[2] who used them in his studies on the Danish species and then extended his "anatomical investigations also to foreign species, intending to bring about a new and better basis for an eventual monograph of the genus *Potamogeton*."[3] In 1907, Chrysler[4] elaborated further on the anatomy of the

[1] See discussion under P. natans.

[2] C. Raunkiaer, De danske Blomsterplanters Naturhistorie, Bind 1, Enkimbladede, p. 32–110 (1895–1899).

[3] C. Raunkiaer, Anatomical Potamogeton-Studies and *Potamogeton fluitans*, Bot. Tids. **25**: 254 (1903).

[4] M. A. Chrysler, Bot. Gaz. **44**: 161–188 (1907).

central cylinder, explaining the phylogenetic relationships of the various types. Hagström in his monograph[1] emphasized the taxonomic value of the anatomical characters, especially of the stem, laying great stress on the types of endodermi, of which he described six kinds, and on the arrangement of bundles in the stele of which he described and illustrated six patterns. Other characters used by him include: the development of mechanical tissue, the presence or absence of a cortical layer directly beneath the epidermis and acting as a supporting layer to it (hypoderma), and the length in proportion to width of the cells of the epidermis.

An examination of hundreds of stems has shown that a number of the characters have real diagnostic and phylogenetic value. These are discussed below.[2] Although it has been suggested that the extent of mechanical tissue present is dependent on whether the plant grows in still or running water,[3] Raunkiaer[4] and Chrysler[5] show that no such correlation can be drawn. Hagström, too, in his Critical Researches, repeatedly shows for many species that the habitat does not affect the essential characters of the stem-anatomy. An aquarium-plant of *P. natans* which I grew from a seed had its mechanical development not at all lessened.

A morphological character of some importance is the degree of branching of the stem. The members of the subsections *Lucentes* and *Perfoliati* are usually much branched; *P. praelongus* of the *Praelongi* and *P. Oakesianus* of the *Natantes* are commonly branched; *P. natans* of the *Natantes* and the members of the *Nodosi*, *Amplifolii*, *Colorati* and *Alpini* are rarely branched, and then usually only slightly so in the upper part of the plant late in the season.

The rhizome appears to offer no important diagnostic characters, at least when dried. Some species tend to have dark-colored (usually reddish) spots on their rhizomes, while others are unspotted, but this is rather inconstant.

[1] J. O. Hagström, Crit. Res. Pot. (1916).

[2] See Explanation of Stem-anatomy Characters used in this Treatment.

[3] S. Schwendener, Das mechanische Princep in anatomischen Bau der Monocotylen, p. 122 (1874).

[4] C. Raunkiaer, Bot. Tids. **25**: 275 (1903).

[5] M. A. Chrysler, Bot. Gaz. **44**: 169 (1907).

Winter Buds. With the exception of *P. crispus*, winter buds are so uncommon among the species here treated as to be of little or no diagnostic value. They have been so ably discussed by Professor Fernald[1] that further remarks are quite unnecessary.

Variation

It is well known that in vegetative characters any broad-leaved species of *Potamogeton* varies considerably. Those of the subsections *Lucentes* and *Perfoliati* have a wide range of variation and all of the species here treated have a variability which is evident. Morong bewailed this characteristic of the group and felt that "so protean are their forms, so eccentric their action, constantly changing under changed conditions of season and water" that he must put forth his treatment "with great diffidence".[2] Chamisso and Schlechtendal[3] had earlier reached the conclusion that, to use the translation of Emmeline Moore[4], "Species of Potamogeton changing their habit seem often to pass into others, and feigning the habit of other species baffle research."

Certain of these differences in form are undoubtedly genetic, but for many the evidence that they are ecological is very strong. Numerous observations and experimental studies have shown that individual plants of certain of the broad-leaved species exhibit a variation that is almost unbelievably wide, not only including many named varieties but even simulating other species. Noteworthy among such experimental studies are those of Esenbeck,[5] whose great contribution from the standpoint of taxonomy was in demonstrating that leaf-shape varies greatly under varying conditions of nutrition and changes of water-level. In general, poor nutrition appeared to give the following sequence of events: the broad floating leaves become increasingly narrower, finally disappear and are replaced by the submerged type, which in turn may be reduced to phyllodia.

[1] M. L. Fernald, Mem. Am. Acad. Arts & Sci. **17**: pt. 1: 18 (1932).
[2] Thomas Morong, Mem. Torr. Club **3**: no. 2: 2 (1893).
[3] Chamisso and Schlechtendal, Linnaea, **2**: 159 (1827).
[4] Emmeline Moore, The Potamogetons in Relation to Pond Culture, Bull. Bur. Fish. **33** (1913): 256 (1915).
[5] Ernst Esenbeck, Beiträge zur Biologie der Gattungen Potamogeton und Scirpus, Flora **107**: 151–211 (1914).

Fryer's experiments with the broad-leaved species which he grew in tubs caused him to prefer a very conservative treatment of the group.

Of outstanding importance in this connection is the work of the Pearsalls[1] who found that variation in size and shape of leaf was due to many factors, acting independently or together. Their results led them to the conclusion that a conservative treatment is the sane one.

While it is known that many of the variations are strictly ecological and one can in many cases name the contributing stimuli, it must be admitted that certain of these differences in form may be genetic. It is often difficult to distinguish from herbarium specimens alone which is the primary cause. When such variants appear to be mere forms or states, without separate geographic ranges, and especially when it is reasonable to suppose that the variations might be caused by ecological factors, it seems wise to refrain from giving them formal rank in our system of nomenclature. In the words of Fryer, "we should not confound temporary states with permanent varieties . . . In looking over an extensive series of dried specimens of any Potamogeton, it is easy to select very distinct looking forms, and as easy to give varietal names to them; this is the method that has been followed by most of the writers on the genus, and I regret to say is still being followed, with the result of confusing rather than elucidating an already too difficult subject."[2]

Hybridism

In dealing with broad-leaved species of *Potamogeton*, one is dealing with plants that are usually sterile, which are highly susceptible to ecological variation and which hybridize freely.

If one classifies all the fruiting specimens, then correlates with them all the sterile plants the vegetative parts of which show their relationships to the fruiting entities, one still has a great mass of material that fits nowhere. Any attempt to understand such material must determine for each specimen whether the variation is genetic or ecological or due to hybridism. Here the internal anatomy of the stem will prove of great assistance and

[1] W. H. Pearsall & W. H. Pearsall, Journ. Bot. 61: 1–7 (1923).
[2] Alfred Fryer, Pot. Brit. Isles, p. 41 (1900).

often will allow the specimen to be rather definitely placed. But many times the stem-anatomy shows an upset; this points toward hybridism, for the species based on fruiting specimens show a stem-anatomy that is remarkably uniform, and repeated observations have shown that ecological factors do not affect the anatomical characters of the stem; neither will minor genetic variations. But one cannot merely say "hybrid," as an easy way out of a difficulty; one should name the parents, usually not an easy thing to do.

Whether experimental studies will produce data of value in this connection, I am not prepared to say. Hagström thought not, saying, "The hybrids must be studied according as Nature produces them. Cultivation and experiments in hybridization may not lead to great results as to the solution of this intricate question."[1] To this, Bennett retorts, "having seen the results of the late Alfred Fryer's work in this direction, I consider cultivation is a very great help—anyhow it affords a negative to some of the proposed hybrids given."[2]

Very little seems to be known about the chromosome number of *Potamogeton*. Wiegand[3] reported a haploid number of seven, or possibly eight, for *P. foliosus*. Wisniewska[4] states that the haploid number for *P. perfoliatus* is probably ("wahrscheinlich") twenty-four. The only other reported count is in Tischler,[5] where the haploid number for *P. fluitans* (*P. nodosus*?) is given as twenty-six, referring to Kuleszanka 1934, without citing any publication. Such data promise interesting results from counts on the species in this genus.

Cytological material (young pollen) of several species which I have examined shows that the chromosome number varies (at least four different numbers) in different species, although absolute counts could not be made.

In the present work, the hybrids are taken up at the end of the general treatment. Only those that strongly simulate the subsections here specially treated are discussed.

[1] J. O. Hagström, Crit. Res. Pot. 12 (1916).
[2] A. Bennett, Journ. Bot. 55: 115 (1917).
[3] K. M. Wiegand, Bot. Gaz. 28: 328–359 (1899).
[4] Ewa Wisniewska, Acta Societatis Botanicorum Poloniae 8: 157 (1931).
[5] G. Tischler, Tab. Biol. Period. 5 & 6, Nachtrag no. 2, Teil no. 2, p. 99 (1935–36).

Acknowledgments

In a study of this nature I have naturally found it convenient to accept the assistance and suggestions so kindly offered by many people. I am especially grateful to Prof. M. L. Fernald under whose guidance the study was conducted and who, by his clear knowledge of the difficulties involved, offered invaluable suggestions. Also to Mr. C. A. Weatherby for his helpful advice, especially concerning nomenclature, I am deeply thankful. Thanks are also due to the members of the Gray Herbarium staff who have so willingly helped with various details; to Prof. F. H. Steinmetz, of the University of Maine, who has taken a keen interest in the work and has assisted greatly in the collecting of material; to my wife, Edith B. Ogden, for assistance in many ways; and to the curators of the herbaria from which plants have been borrowed.

Herbarium material has been seen from the following sources: Gray Herbarium (G), New England Botanical Club (NE), New York Botanical Garden (NY), United States National Museum (US), Field Museum (F), Missouri Botanical Garden (M), Dudley Herbarium, Stanford University (S), Michigan State College (MSC), National Museum, Ottawa, Canada (C), University of Montreal (MT), Private herbarium of Marie-Victorin (V), University of Maine (ME), Portland [Maine] Society of Natural History (P), University of New Hampshire (NH), C. C. Deam (D), private herbarium, E. C. Ogden (O).

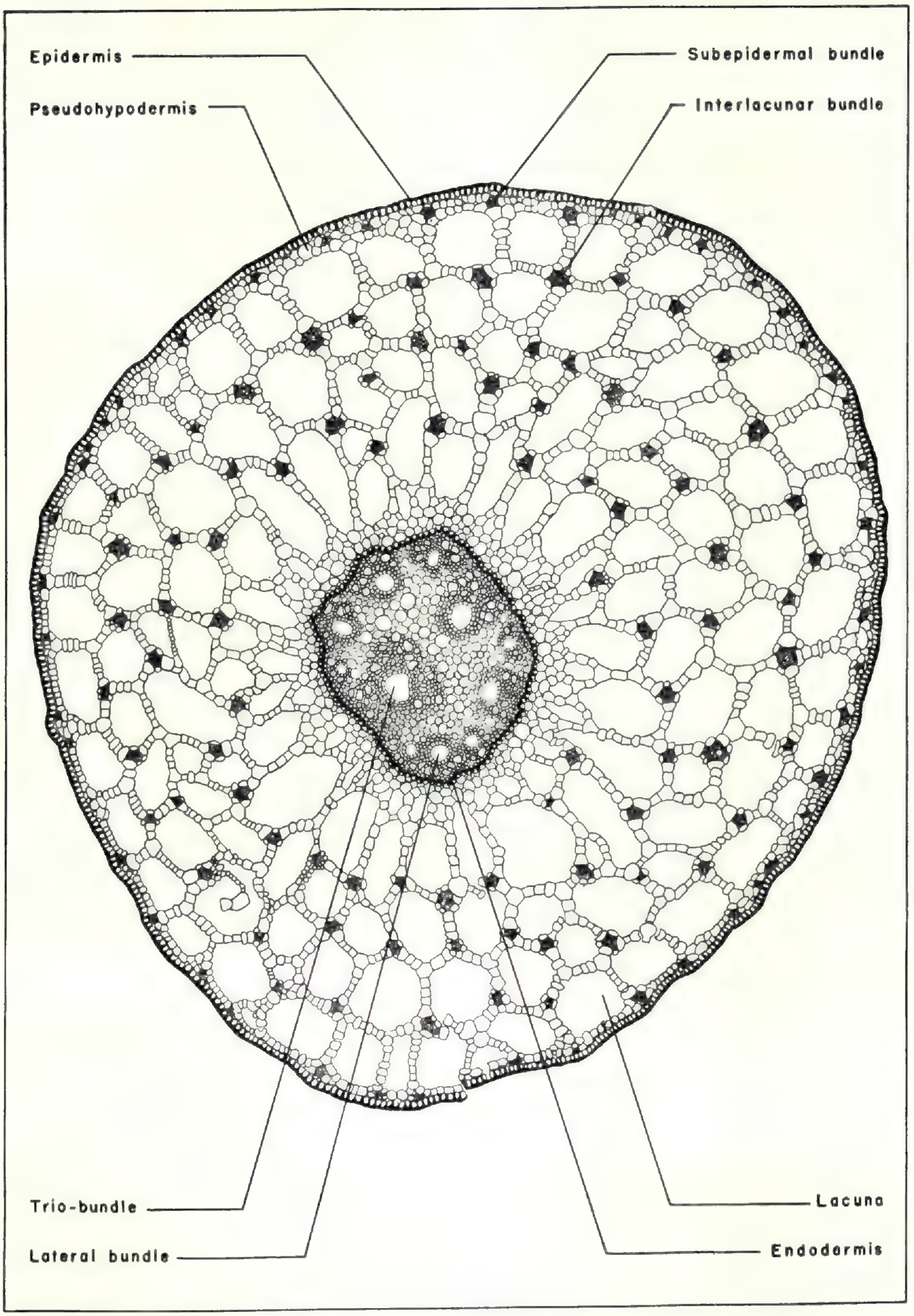
Explanation of Stem-anatomy Characters used in this Treatment

Five sets of characters are used, combinations of which should determine the species. These are: the arrangement of bundles in the stele, the type of thickening of the cells of the endodermis, the presence or absence of bundles in the interlacunar spaces of the cortex (interlacunar bundles), the presence or absence of bundles just underneath the epidermis (subepidermal bundles), and the presence or absence of a layer or layers of cells directly underneath the epidermis (pseudo-hypodermis). See PLATE 747.

One of the most important sets of characters is that of the

arrangements of bundles in the stele. These fall into six types. The arrangement called the proto-type (because it appears to be the type from which the others are derived) is illustrated by PLATE 748, FIG. 1. Here the bundles are all free and un-united (each having one patch of phloem), four of them being median and with usually three to five on each side. When this arrangement is found, the specimen will belong to one of the subsections: *Colorati*, *Amplifolii*, *Lucentes*, or *Praelongi*. In the trio-type (FIGS. 2 & 3) three of the median bundles have united to form a bundle "trio", giving only two median bundles, one of them with a patch of phloem on the outer face of the xylem canal and two patches of phloem on the inner face (FIG. 2), or by a further union having only one inner patch of phloem (FIG. 3). The trio-type is always found in the subsections: *Alpini*, *Nodosi*, *Natantes* and *Perfoliati*. Members of the subsection *Lucentes* may also have the trio-type of stele. A further reduction in the number of bundles is brought about by the fusion of the lateral bundles and as this invariably results in an oblong-shaped stele it is called the oblong-type. The two median bundles may remain separate (FIG. 4) and even the lateral bundles may at times be scarcely united but merely crowded together. The oblong-type with two median bundles is found in the subsection *Lucentes*, and is prevalent in hybrids having a member of the *Lucentes* as one of the parents. A fusion of the two median bundles is accompanied by the more or less complete fusion of the laterals on each side, resulting in a stele of an oblong (or elliptic) shape with but three bundles (FIG. 5). This is the usual type in the subsections *Crispi* and *Lucentes*. The final reduction to the one-bundled-type (FIG. 6) is not met with in the broad-leaved species, but is found in the hybrid *P. Berchtoldi* × *perfoliatus* var. *bupleuroides*.

The cells of the endodermis give an important set of diagnostic characters. Although several types can be recognized, these have been grouped in the present treatment into two principal types, according to the type of incrassation of the cell-walls. Cells which are thickened evenly or not at all are called O-cells; those which are much thickened on the inner and lateral faces but remain thin on the face next to the cortex are called U-cells. This latter type of endodermis is always found in the *Natantes*,



Potamogeton natans: Cross-section of Stem, × 35

Lucentes, and *Praelongi*. All the others here treated have O-cells.

The bundles of the cortex give exceptionally good sets of characters. The cortex of a *Potamogeton* stem is highly lacunate. At the junctures of the walls separating these lacunae may, in some species, be found bundles composed of vascular tissue and fibers or merely of fibers alone. These are called interlacunar bundles and are well developed in the *Natantes*, *Lucentes*, *Praelongi*, and in *P. amplifolius* of the *Amplifolii*. The other subsections are devoid of them, or rarely have one or two weakly developed.

The cortical bundles found directly underneath the epidermis are called subepidermal bundles. They are seldom as strongly developed as the interlacunar bundles, yet they furnish a set of characters which is quite useful. The subepidermal bundles are present in the *Colorati*, *Natantes*, *Praelongi*, and usually in the *Lucentes*, but absent in the other subsections.

The last set of characters used is the presence or absence of a layer or layers of cells directly beneath and adjacent to the epidermis. This is called the pseudo-hypodermis. It is always present in the *Crispi*, *Amplifolii*, *Praelongi*, and *Perfoliati*, but is not present in the *Alpini* and *Nodosi*, whereas the *Colorati*, *Natantes*, and *Lucentes* may or may not have it.

A number of methods of preparing a section of stem for anatomical examination may be used. The following procedure has been found to be simple and rapid and highly satisfactory. When a choice can be made as to the part of the stem to be sectioned it should be at about the middle of the second or third internode below the lowest peduncle. However, any portion of the stem, if not too close to a node, is usually quite satisfactory. The piece of stem is boiled in water for a few minutes to soften and expand the tissues, then dropped into cold water to reduce flabbiness. A clean transverse cut is made near one end with a sharp razor-blade and this end dipped into ordinary blue ink, or other stain, for a second or two. The stem is now rinsed briefly in cold water and rolled on a blotter to remove excess water. With the razor-blade a thin free-hand section is taken off at the stained end, a water-mount made (stained end up), and examined under a microscope. If the stem is badly flattened, it can be

teased out with fine needles. A magnification of about 100 diameters is highly satisfactory, although much lower powers will enable one to determine most of the essential characters. Such mounts need not be thinner than that obtainable by free-hand sectioning, for enough light will come through the lacunae to illuminate the tissues.

The amount of time necessary for making an anatomical examination of a stem need not be greater than that necessary for boiling and dissecting a flower.

A number of improvements can undoubtedly be made on this method, but mostly at the sacrifice of simplicity and speed. Potassium hydroxide solution is not recommended for swelling the tissues as it destroys the delicate cortex. A weak lactic acid solution will soften tissues quickly and swell them slightly without destroying the cortex, but for most specimens water is more satisfactory. If cold water does not stiffen the material sufficiently for proper sectioning, a few drops of concentrated ammonia in the water are helpful.

Ordinary blue fountain-pen ink is suggested as a stain because it is easily available and has proved very satisfactory. It acts quickly and as a differential stain: coloring the vascular tissue deep blue and the cortical and pith cells light blue; the mechanical tissue (sclerenchyma) usually remaining a bright yellow and the endodermis usually yellow or orange. The clearer results obtained by aniline dyes are not necessary for this work. A two-solution differential stain is not recommended for speedy examination.

The Classification of North American Pondweeds

In order that the groups of *Potamogeton* here specially discussed may be properly oriented, an outline (largely following Hagström and Fernald) of the relationships of North American species is here appended. The subsections treated in this paper are indicated by asterisks.

Subgenus Coleogeton (Reichenb.) Raunk.
  Section Connati Hagstr.
    Subsect. Filiformes Hagstr. (*P. filiformis* Pers., *P. latifolius* (Robbins) Morong).

Section Convoluti Hagstr.
Subsect. Vaginati Hagstr. (*P. vaginatus* Turcz.).
Subsect. Pectinati (Fries) Hagstr. (*P. pectinatus* L.).
Subgenus Eupotamogeton Raunk.
Section Adnati Hagstr.
Subsect. Serrulati Hagstr. (*P. Robbinsii* Oakes).
Section Axillares Hagstr.
*Subsect. Crispi Wallm. (*P. crispus* L.).
Subsect. Monticoli Hagstr. (*P. confervoides* Reichenb.).
Subsect. Compressi (Fries) Hagstr. (*P. zosteriformis* Fern.).
Subsect. Oxyphylli Hagstr. (*P. Porsildiorum* Fern., perhaps also *P. longiligulatus* Fern.).
Subsect. Pusilli (Graebn.) Hagstr.
Series Pusilli connati Hagstr.
Subseries Foliosi Fern. (*P. foliosus* Raf., *P. fibrillosus* Fern.).
Subseries Panormitani Fern. (*P. Friesii* Rupr., *P. strictifolius* Ar. Benn., *P. pusillus* L.).
Series Pusilli convoluti Hagstr.
Subseries Acuti Hagstr. (*P. gemmiparus* Robbins, *P. Hillii* Morong; *P. longiligulatus* Fern., an atypical species, may belong in the *Oxyphylli*).
Subseries Obtusi Hagstr. (*P. Porteri* Fern., *P. obtusifolius* Mert. & Koch, *P. clystocarpus* Fern., *P. Berchtoldi* Fieber).
Subsect. Javanici Graebn. (*P. Vaseyi* Robbins, *P. lateralis* Morong).
Subsect. Hybridi (Graebn.) Hagstr., in part; *i. e.*
Series Euhybridi Hagstr. (*P. Spirillus* Tuckerm., *P. diversifolius* Raf., *P. capillaceus* Poir., *P. bicupulatus* Fern.).
Subsect. Nuttalliani (Hagstr.) Fern. (*P. epihydrus* Raf., *P. tennesseensis* Fern.).
*Subsect. Alpini (Graebn.) Hagstr. (*P. alpinus* Balbis).
*Subsect. Colorati (Graebn.) Hagstr. (*P. polygonifolius* Pourr.).
*Subsect. Amplifolii Hagstr. (*P. amplifolius* Tuckerm., *P. pulcher* Tuckerm.).
*Subsect. Nodosi Hagstr. (*P. nodosus* Poir.).
*Subsect. Natantes Graebn. (*P. natans* L., *P. Oakesianus* Robbins).
*Subsect. Lucentes Graebn. (*P. gramineus* L., *P. illinoensis* Morong).
*Subsect. Praelongi Hagstr. (*P. praelongus* Wulfen).
*Subsect. Perfoliati (Graebn.) Hagstr. (*P. Richardsonii* (Benn.) Rydb., *P. perfoliatus* L.).

KEY TO THE BROAD-LEAVED NORTH AMERICAN SPECIES OF POTAMOGETON

1. Stem laterally compressed; leaves all submersed, margins toothed; stipules slightly adnate to base of leaf; fruits with beak 2–3 mm. long; winter buds hard and horny; stele of the oblong-type pattern; endodermis of O-cells; interlacunar bundles absent.[1] (subsect. CRISPI) ..... 1. *P. crispus.*

1. Stem terete; leaf-margins entire or minutely denticulate; stipules completely free from leaf-base; fruits with beak not more than 1 mm. long; winter buds rare, not hard and horny; stele with the pattern various in type; if of the oblong-type, then endodermis of U-cells and interlacunar bundles present ....2.

2. Submersed leaves petioled or tapering to a sessile base, scarcely clasping; floating leaves present or absent ....3.

3. Submersed leaves sessile; floating leaves (usually absent) delicate, translucent, tapering without sharp distinction into the petiole; fruits with exocarp hard and smooth, tawny-olive (subsect. ALPINI) ..... 2. *P. alpinus.*

3. Submersed leaves sessile or petioled; floating leaves coriaceous, opaque, cordate to cuneate at base, blade distinct from petiole; fruits with exocarp soft and porous, greenish, brownish, or reddish ....4.

4. Sepaloid connectives 1–2 mm. wide; fruiting spikes 5–7 mm. thick; fruits 1.6–2.5 mm. long, keels rounded or none, beak obsolete or nearly so, endocarp loop usually with a cavity; interlacunar bundles absent; subepidermal bundles present; eastern Newfoundland and Sable Island, Nova Scotia (subsect. COLORATI) ..... 3. *P. polygonifolius.*

4. Sepaloid connectives mostly 1.2–3 mm. wide; fruiting spikes 6–15 mm. thick; fruits mostly 2–5 mm. long, keels variable, beak evident, endocarp loop solid; interlacunar bundles absent or present; if absent, then subepidermal bundles absent; widespread ....5.

5. Submersed leaves broadly linear, lanceolate, or ovate, less than 30 times as long as broad, nerves 3–37; stele with the pattern various in type; if of the trio-type, then with but 1 patch of phloem on the inner face of the trio-bundle ....6.

6. Submersed leaves with 11–37 nerves, margins strictly entire; floating leaves cordate to rounded at base, nerves mostly more than 21; stele with the proto-type pattern; endodermis of O-cells (subsect. AMPLIFOLII) ....7.

7. Stem not conspicuously black-spotted; submersed leaves usually arcuate, 2.5–7.5 cm. wide; floating leaves cuneate or rounded at base, mostly with more than 30 nerves, about ¼ of the nerves more prominent than the rest as seen by transmitted light; peduncles often clavate; fruits cuneate at base, 3.5–4.5 (–5) mm. long; interlacunar bundles present ..... 4. *P. amplifolius.*

7. Stem usually conspicuously black-spotted; submersed leaves not arcuate, 1–2.5 cm. wide;

[1] Anatomical characters refer to those of the stem. See p. 67 and keys on pages 75 and 77–85.

floating leaves cordate or rounded at base, mostly with less than 30 nerves, all nerves of about equal prominence as seen by transmitted light; peduncles not conspicuously clavate; fruits rounded or lobed at base, 3–3.5 (–4) mm. long; interlacunar bundles absent ..... 5. *P. pulcher.*

6. Submersed leaves with 3–29 nerves, margins with fugacious one-celled translucent denticles; floating leaves cuneate to rounded at base, their nerves mostly less than 21; stele with the pattern various in type; if of the proto-type pattern, then endodermis of U-cells....8.

8. Submersed leaves with petioles 2–13 cm. long, apex acutish but not sharp-pointed nor mucronate; fruits 3.5–4 mm. long, usually reddish, keels mostly muricate; endodermis of O-cells; interlacunar bundles absent (subsect. Nodosi) ..... 6. *P. nodosus.*

8. Submersed leaves sessile or with petioles up to 4 cm. long, apex acutish or sharp-pointed, often somewhat mucronate; fruits 1.7–3.5 mm. long, usually greenish, keels scarcely muricate; endodermis of U-cells; interlacunar bundles present (subsect. Lucentes)....9.

9. Stem usually much branched, .5–1 mm. in diameter; submersed leaves .2–1 (–1.5) cm. wide, (5–) 7–12 (–30) times as long as wide, sessile, nerves mostly 3–9; floating leaves 1.5–5 (–7) cm. long, 1–2 (–3) cm. wide, petioles mostly longer than the blades; stipules .5–3 cm. long, .1–.2 mm. wide, keels faint; peduncles clavate or not; fruiting spikes 1–2.5 cm. long, .6–.8 cm. thick; sepaloid connectives mostly 1.2–1.6 mm. wide; fruits 1.7–2.5 (–2.8) cm. long, 1.6–2 (–2.3) cm. wide; stele of the oblong-type pattern with 1 (rarely with 2) central bundles and 1 lateral bundle on each side; interlacunar bundles only in the outer interlacunar circle..... 9. *P. gramineus.*

9. Stem simple or once branched, (1–) 1.5–5 mm. in diameter; submersed leaves 1.5–4 cm. wide, mostly 3–5 times as long as wide, sessile or petiolate, nerves mostly 9–17; floating leaves 4–13 cm. long, 2–6.5 cm. wide, petioles mostly shorter than the blades; stipules (1–) 2.5–8 cm. long, (.3–) .5–1.2 mm. wide, keels prominent; peduncles not clavate; fruiting spikes (2.5–) 3–6 cm. long, .8–1 cm. thick; sepaloid connectives mostly 1.6–3 mm. wide; fruits (2.5–) 2.7–3.5 cm. long, (2.1–) 2.2–3 cm. wide; stele with the pattern various in type; interlacunar bundles in the outer interlacunar circle or sometimes also in the other interlacunar circles..... 10. *P. illinoensis.*

5. Submersed leaves narrowly linear, less than 3 mm.

wide and more than 50 times as long as broad, nerves 1–5; stele of the trio-type pattern with 2 patches of phloem on the inner face of the trio-bundle (subsect. Natantes) . . . . 10.

10. Stem .8–2 mm. in diameter; submersed leaves .8–2 mm. wide; floating leaf-blades 4–9 cm. long, 2.5–6 cm. wide, usually cordate at base, on petioles 1–2.5 mm. thick; stipules 4.5–11 cm. long, strongly keeled; peduncles as thick as the stem; sepaloid connectives mostly 1.8–2.2 mm. wide; fruiting spikes .9–1.2 cm. thick; mature fruits mostly 3.5–5 mm. long, 2.5–3.5 mm. wide, keels scarcely developed, endocarp usually pitted on the sides, apex of seed pointing toward the basal end; stele with 3–5 lateral bundles on each side; interlacunar bundles strongly developed in more than 1 interlacunar circle; pseudo-hypodermis present; epidermal cells 1.5–3 (–4) times as long as broad . . . . . 7. *P. natans.*

10. Stem .5–1 mm. in diameter; submersed leaves .25–1 mm. wide; floating leaf-blades 1.5–5.5 cm. long, 1–3 cm. wide, rounded or cuneate at base, on petioles .2–1 mm. thick; stipules 1–5.5 cm. long, keels prominent only at base; peduncles thicker than the stem; sepaloid connectives mostly 1.3–1.8 mm. wide; fruiting spikes .7–.9 cm. thick; mature fruits mostly 2.5–3.5 mm. long, 2–2.4 mm. wide, keels prominent, endocarp sometimes depressed on the sides but not pitted, apex of seed pointing a little above the basal end; stele with 2–3 lateral bundles on each side; interlacunar bundles strongly developed in but 1 interlacunar circle; pseudo-hypodermis usually absent; epidermal cells 4–7 times as long as broad 8. *P. Oakesianus.*

2. Leaves all submersed, cordate or rounded at base, clasping ½ to ¾ the circumference of the stem . . . . 11.

11. Rhizomes spotted with rusty red; leaves ovate-oblong (5–) 10–20 (–25) cm. long, apex often cucullate, margins entire; stipules usually persistent and conspicuous; peduncles (5–) 15–60 cm. long; fruits more than 4 mm. long and more than 3 mm. wide, dorsal keel strongly developed; stele with the proto-type pattern; endodermis of U-cells; interlacunar and subepidermal bundles present (subsect. Praelongi) . . . . . 11. *P. praelongus.*

11. Rhizomes unspotted; leaves orbicular to ovate-lanceolate, seldom ovate-oblong, 1–10 cm. long, apex not cucullate, margin with fugacious, translucent, one-celled denticles; stipules usually inconspicuous or disintegrated to fibers; peduncles 1–25 cm. long; fruits less than 3.5 mm. long and less than 3 mm. wide, dorsal keel weakly developed, or none; stele with the trio-type pattern; endodermis of O-cells; interlacunar and subepidermal bundles absent (subsect. Perfoliati) . . . . 12.

12. Leaves ovate-lanceolate to narrowly lanceolate, 3–10 cm. long, coarsely nerved; stipules coarse, disinte-

grating to persistent whitish fibers; peduncles often clavate, 1.5–25 cm. long; fruiting spikes about 1 cm. thick; fruits (2.5–) 2.7–3.2 (–3.5) mm. long, (2–) 2.3–2.6 (–3) mm. wide; endocarp-loop with a cavity.....12. *P. Richardsonii.*

12. Leaves orbicular to ovate-lanceolate, the principal ones 1–6 cm. long, delicately nerved; stipules delicate, fugacious; peduncles never clavate, 1–9 cm. long; fruiting spikes about .8 cm. thick; fruits (2.3–) 2.5–2.7 (–3) mm. long, (1.7–) 2–2.1 (–2.3) mm. wide; endocarp-loop solid.....13. *P. perfoliatus.*

Key to the Species Based on the Anatomy of the Stem

1. Interlacunar bundles present....2.
   2. Interlacunar bundles strongly developed throughout....3.
      3. Stele of the proto-type pattern....4.
         4. Endodermis of O-cells; subepidermal bundles absent 4. *P. amplifolius.*
         4. Endodermis of U-cells; subepidermal bundles present 11. *P. praelongus.*
      3. Stele of the trio-type pattern, with the phloem on the inner face of the trio-bundle appearing as 2 distinct patches; endodermis of U-cells; subepidermal bundles present.....7. *P. natans.*
   2. Interlacunar bundles strongly developed only in the outer interlacunar circle (if present in other interlacunar circles, then few or weakly developed); endodermis of U-cells....5.
      5. Stele of the trio-type or proto-type pattern....6.
         6. Stele of the trio-type pattern with the phloem on the inner face of the trio-bundle appearing as 2 distinct patches; epidermal cells 4–7 times as long as broad 8. *P. Oakesianus.*
         6. Stele various in pattern; epidermal cells 1–4 times as long as broad.....10. *P. illinoensis.*
      5. Stele of the oblong-type pattern....7.
         7. Stele with 1 (rarely with 2) central bundle and usually but 1 lateral bundle on each side; interlacunar bundles only in the outer interlacunar circle; stem .5–1 mm. in diameter.....9. *P. gramineus.*
         7. Stele with 2 (rarely with 1) central bundles and 2 or 3 lateral bundles on each side; interlacunar bundles in the outer interlacunar circle and sometimes also in the other interlacunar circles; stem (1–) 1.5–2.5 mm. in diameter.....10. *P. illinoensis.*
1. Interlacunar bundles absent; endodermis of O-cells (rarely with a few U-cells)....8.
   8. Stele of the oblong-type pattern; stem laterally compressed.....1. *P. crispus.*
   8. Stele of the trio-type or proto-type pattern; stem terete....9.
      9. Stele with the proto-type pattern....10.
         10. Subepidermal bundles present.....3. *P. polygonifolius.*
         10. Subepidermal bundles absent.....5. *P. pulcher.*
      9. Stele with the trio-type pattern....11.
         11. Stele with the phloem on the inner face of the trio-bundle appearing as 1 patch; pseudo-hypodermis absent.....6. *P. nodosus.*

11. Stele with the phloem on the inner face of the trio-bundle appearing as 2 patches (rarely with but 1)....12.
12. Pseudo-hypodermis present.....12. *P. Richardsonii* and 13. *P. perfoliatus.*
12. Pseudo-hypodermis absent.....2. *P. alpinus.*

Selective Key to the Subsections

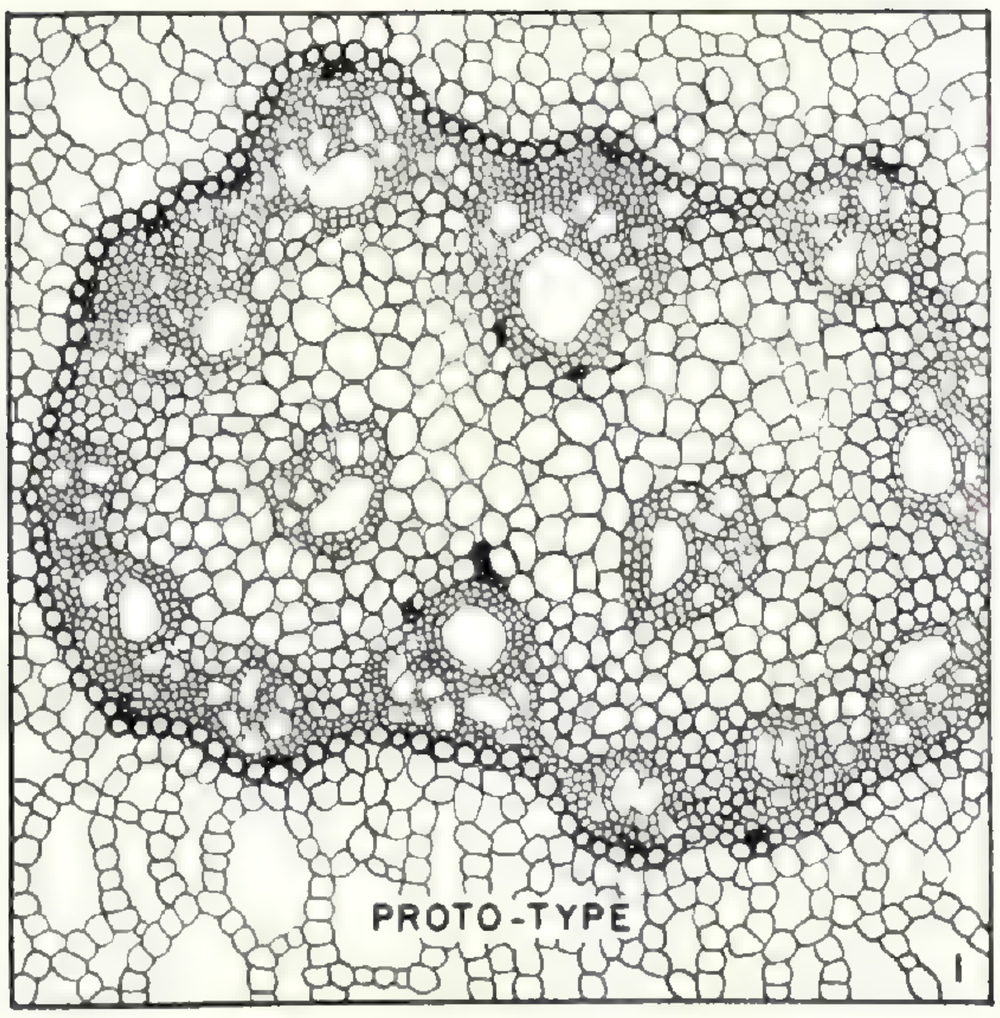
The following key is offered as a practical one for determining the subsection to which a specimen belongs. It is based on characters available with sterile and otherwise incomplete specimens. It is selective in that the user may choose the order in which the characters may be applied. This is of decided advantage when certain parts of the specimen are absent or difficult to make out, for the other parts may be sufficient for determining the subsection.

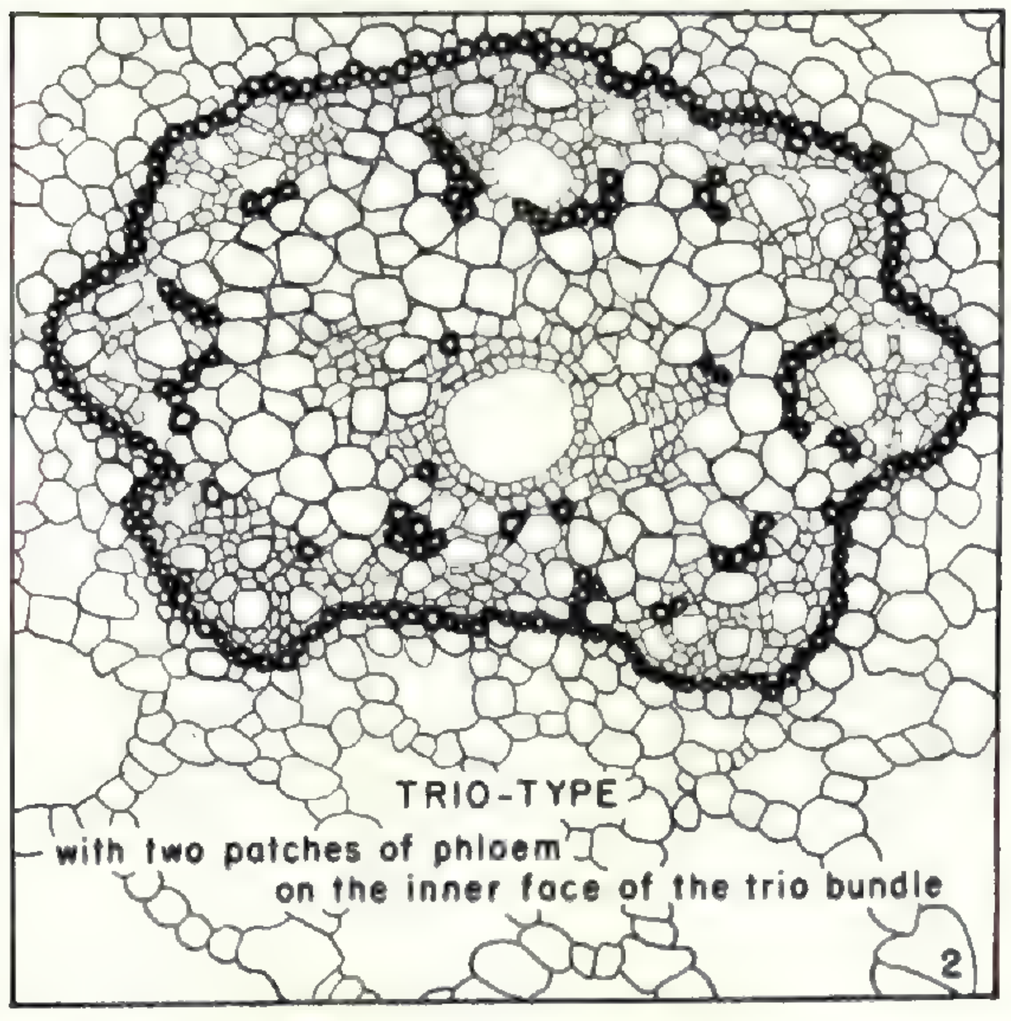
The key is extremely easy to use. Any character may be selected which, if not sufficient to name the subsection, will lead to a number. This number will be found heading a column on one of the following pages. On this page another character is now selected and opposite it in the designated column may be found a symbol or new number. This is continued until a symbol appears, which will designate the proper subsection. At any time the subsections that are still possibilities may be ascertained by reference to page 86. If a specimen traces to zero (0) it may be suspected that a character has been selected incorrectly or the specimen is a hybrid with parents in more than one subsection. The subsection *Crispi* is omitted from this key for it is represented only by the introduced species *P. crispus*, which can easily be distinguished from all our indigenous species of *Potamogeton* by its definitely toothed leaf-margins.

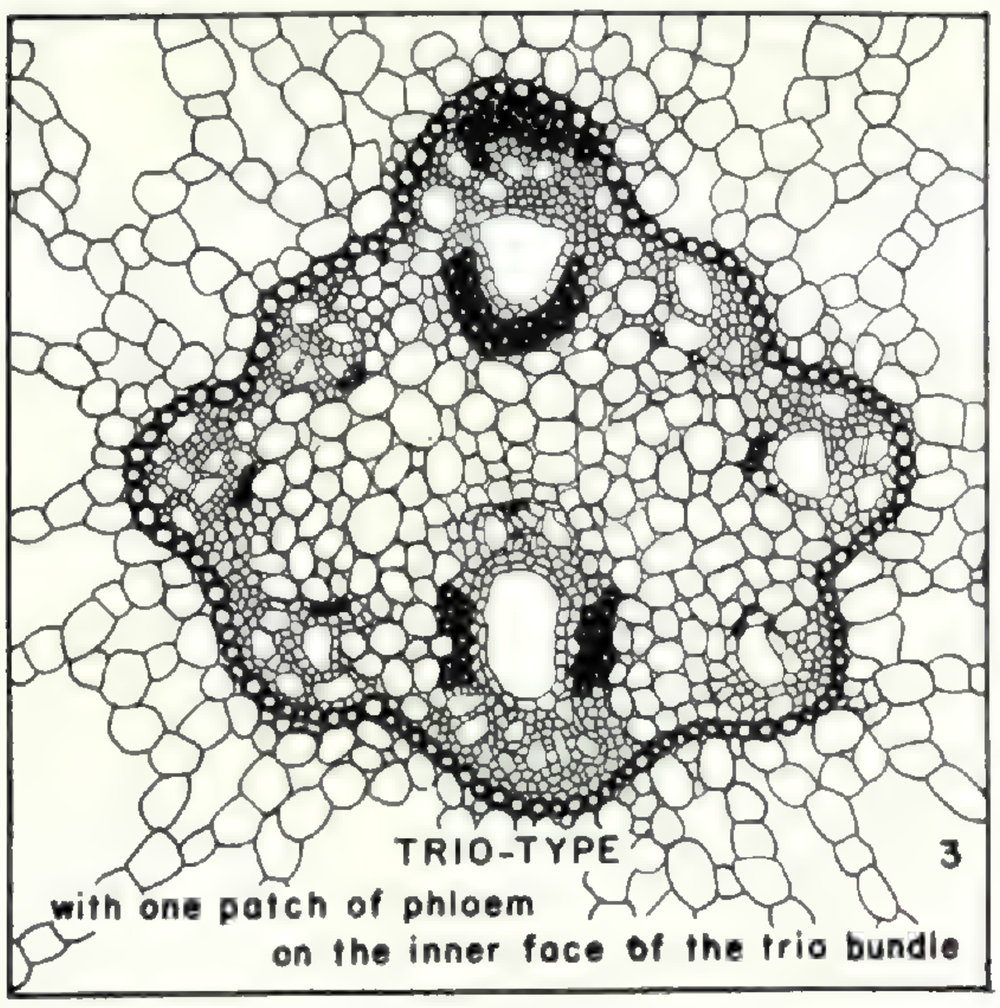
When the subsection is determined, reference to the portion of the general key, on pages 72 to 75, dealing with that subsection should give the name of the species.

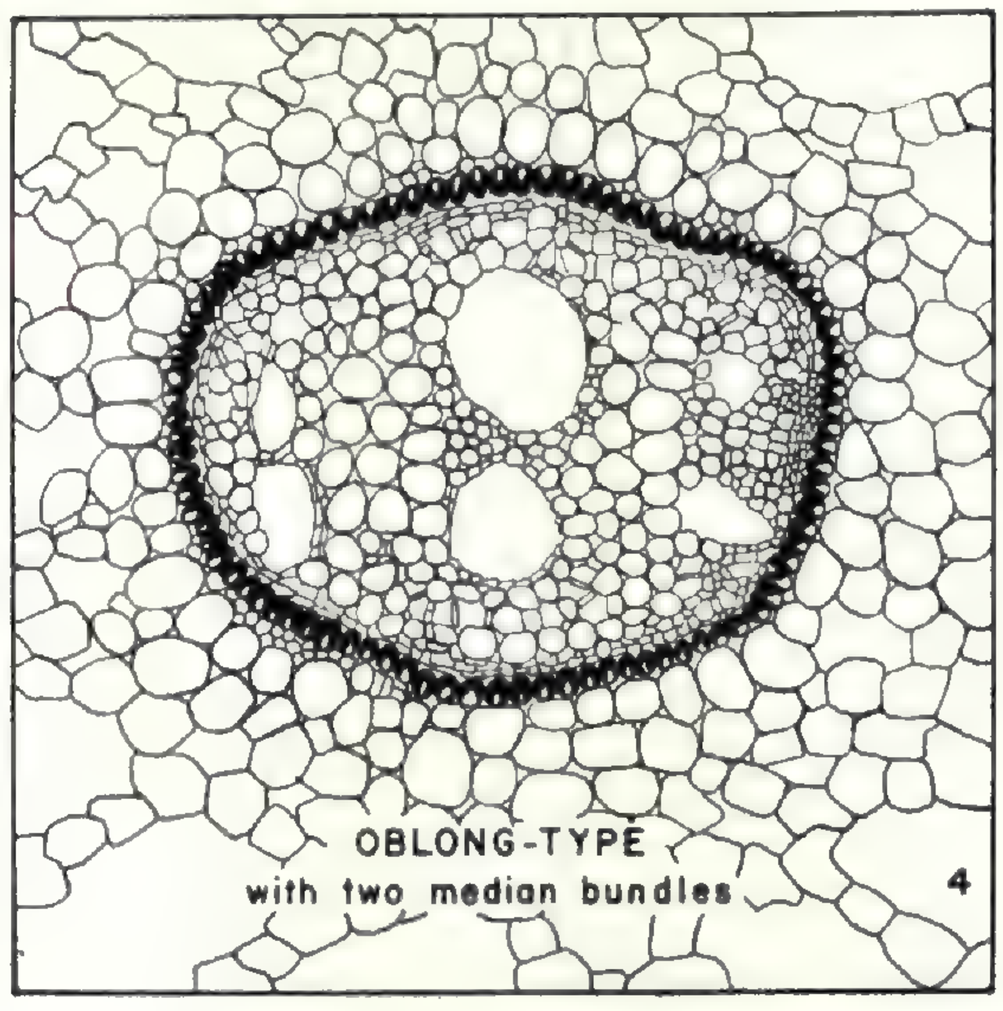
The following symbols are used to designate the subsections:

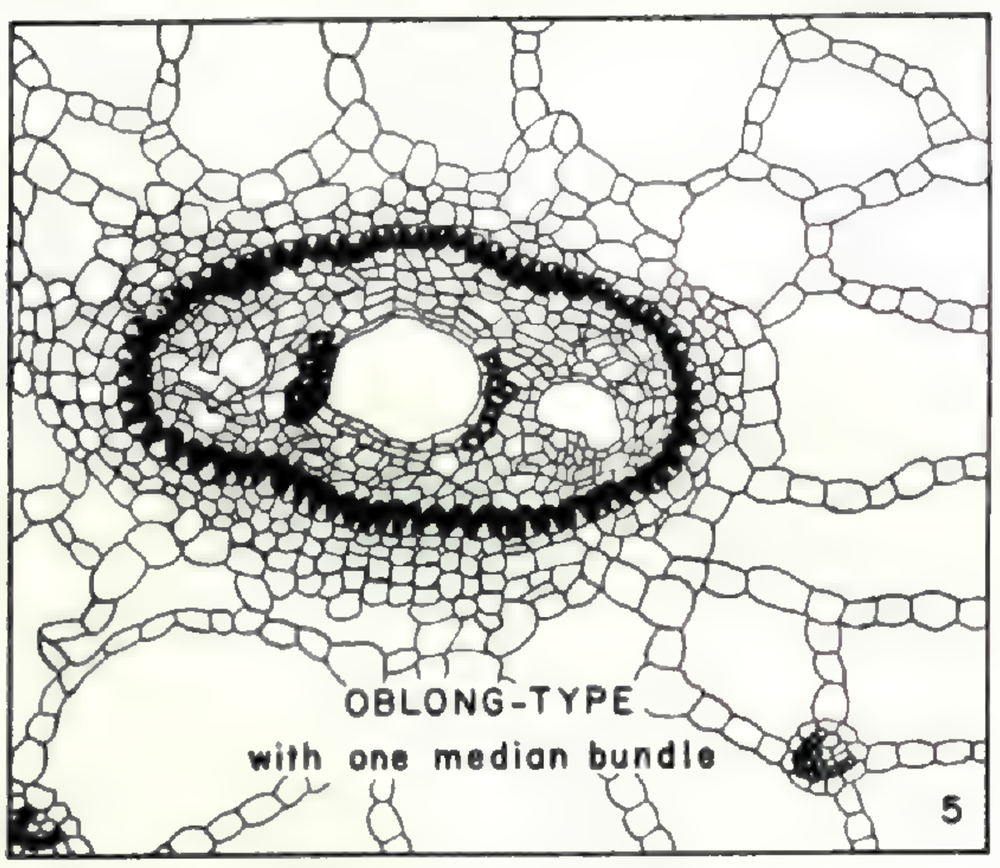
AL *Alpini*	AM *Amplifolii*	NA *Natantes*	PR *Praelongi*
CO *Colorati*	NO *Nodosi*	LU *Lucentes*	PE *Perfoliati*

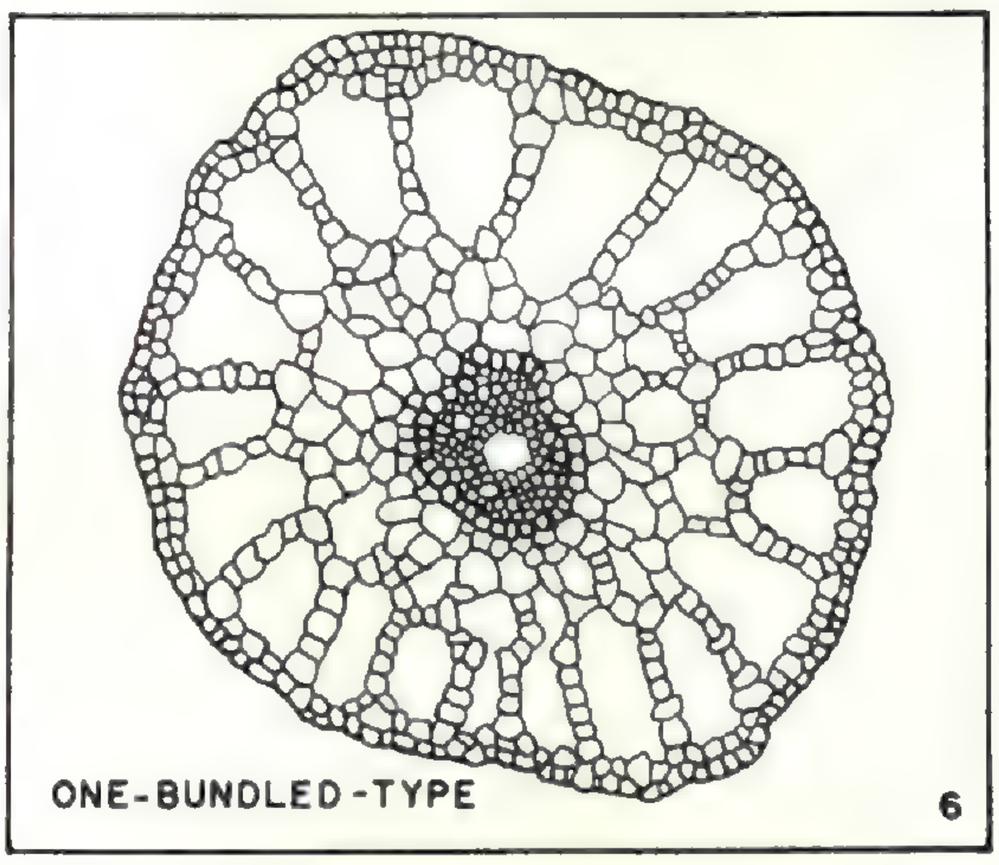












Camera-lucida Drawings (cell-contents not shown) from Stems of Potamogeton showing Types of Steles.

STEM		
STELE		
Proto-type	CO AM LU PR	18
Trio-type	AL NO NA LU PE	8
Oblong-type		LU
ENDODERMIS		
O-cells	AL CO AM NO PE	11
U-cells	CO NA LU PR	17
INTERLACUNAR BUNDLES		
Present	AM NA LU PR	15
Absent	AL CO AM NO PE	11
SUBEPIDERMAL BUNDLES		
Present	CO NA LU PR	17
Absent	AL AM NO LU PE	10
SUBMERSED LEAVES		
SHAPE		
Orbicular	AM PE	66
Ovate	AM LU PR PE	13
Oblong	AL IL PR	48
Lanceolate	AL CO AM NO LU PR PE	2
Oblanceolate or elliptic	AL AM LU	55
Linear	NO NA LU	33
BASE		
Clasping	AL PR PE	46
Not clasping	AL CO AM NO NA LU	5
APEX		
Rounded	AL NA PR PE	20
Acutish	AL CO AM NO LU PE	4
Sharp-pointed	AM NO LU	40
Mucronate	AM LU	68
PETIOLE		
Present	CO AM NO LU	19
Absent	AL AM NA LU PR PE	3
MARGIN		
Entire	AL CO AM NO NA LU PR PE	1
Denticulate	NO LU PE	32
NERVES		
1–5	AL NO NA LU PE	8
6–11	AL CO AM NO LU PE	4
12–21	AM NO LU PR PE	6
22–	AM PR PE	34
STIPULES		
Intact and well developed	AL CO AM NO NA LU PR PE	1
Disintegrated to fibers	AM NA PR PE	14
Delicate or fugacious	AL AM PR PE	24
FLOATING LEAVES		
BASE		
Cordate	CO AM NA	44
Rounded or cuneate	CO AM NO NA LU	7
Tapering		AL
NERVES		
1–10	AL NO NA	53
11–23	AL CO AM NO NA LU	5
24–	AM NA LU	38

STEM	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Stele										
Proto-type	18	18	36	43	43	36	43	LU	36	68
Trio-type	8	22	21	22	23	32	33	8	47	22
Oblong-type	LU	LU	LU	LU	LU	LU	LU	LU	LU	LU
Endodermis										
O-cells	11	11	54	78	29	39	45	51	54	27
U-cells	17	41	31	71	42	59	42	62	59	LU
Interlacunar B.										
Present	15	36	15	68	38	36	38	62	36	68
Absent	11	11	54	11	29	39	45	51	54	27
Subepidermal B.										
Present	17	41	31	71	42	59	42	62	59	LU
Absent	10	10	25	10	28	16	40	22	25	10
SUBMERSED LEAVES										
Shape										
Orbicular	66	66	66	66	AM	66	AM	PE	66	66
Ovate	13	13	13	35	68	13	68	58	13	35
Oblong	48	48	48	76	76	59	LU	76	48	76
Lanceolate	2	2	9	4	12	6	19	22	9	10
Oblanc. or ell.	55	55	55	55	55	68	68	76	55	55
Linear	33	64	62	64	33	64	33	33	LU	64
Base										
Clasping	46	46	46	74	AL	57	0	74	46	74
Not clasping	5	12	26	12	5	40	7	23	55	28
Apex										
Rounded	20	46	20	74	77	57	NA	49	46	74
Acutish	4	4	25	4	12	16	19	22	25	10
Sharp-pointed	40	40	68	40	40	40	40	64	68	40
Mucronate	68	68	68	68	68	68	68	LU	68	68
Petiole										
Present	19	19	68	19	19	40	19	64	68	40
Absent	3	9	3	25	26	13	38	21	9	25
Margin										
Entire	1	2	3	4	5	6	7	8	9	10
Denticulate	32	32	58	16	64	32	64	32	58	32
Nerves										
1–5	8	22	21	22	23	32	33	8	47	22
6–11	4	4	25	4	12	16	19	22	25	10
12–21	6	6	13	16	40	6	40	32	13	16
22–	34	34	34	66	AM	34	AM	PE	34	66
STIPULES										
Intact	1	2	3	4	5	6	7	8	9	10
Fibers	14	34	14	66	69	34	69	60	34	66
Del. or fug.	24	24	24	54	79	34	AM	74	24	54
FLOATING LEAVES										
Base										
Cordate	44	73	69	73	44	AM	44	NA	AM	AM
Round. or cun.	7	19	38	19	7	40	7	33	68	40
Tapering	AL	AL	AL	AL	AL	0	0	AL	AL	AL
Nerves										
1–10	53	78	77	78	53	NO	65	53	AL	78
11–23	5	12	26	12	5	40	7	23	55	28
24–	38	68	38	68	38	68	38	62	68	68

STEM	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
STELE										
Proto-type	73	43	36	67	36	68	41	18	43	PR
Trio-type	51	52	58	60	62	32	62	LU	64	49
Oblong-type	0	LU	LU	0	LU	LU	LU	LU	LU	0
ENDODERMIS										
O-cells	11	29	66	66	AM	39	CO	73	45	74
U-cells	CO	71	59	61	31	LU	17	41	71	61
INTERLACUNAR B.										
Present	AM	68	36	37	15	68	31	36	68	61
Absent	11	29	66	66	AM	39	CO	73	45	74
SUBEPIDERMAL B.										
Present	CO	71	59	61	31	LU	17	41	71	61
Absent	27	28	35	66	68	16	LU	68	40	74
SUBMERSED LEAVES										
SHAPE										
Orbicular	66	AM	66	66	AM	66	0	AM	AM	PE
Ovate	66	68	13	34	36	35	59	36	68	57
Oblong	AL	76	59	PR	59	LU	59	59	LU	75
Lanceolate	11	12	13	34	36	16	41	18	19	46
Oblanc. or ell.	79	55	68	AM	68	68	LU	68	68	AL
Linear	NO	64	LU	NA	62	64	62	LU	64	NA
BASE										
Clasping	74	AL	57	57	PR	PE	PR	PR	0	46
Not clasping	29	12	68	69	38	40	42	43	19	77
APEX										
Rounded	74	AL	57	30	61	PE	61	PR	0	20
Acutish	11	12	35	66	68	16	71	43	19	74
Sharp-pointed	70	40	68	AM	68	40	LU	68	40	0
Mucronate	AM	68	68	AM	68	68	LU	68	68	0
PETIOLE										
Present	45	19	68	AM	68	40	71	43	19	0
Absent	54	55	13	14	15	35	31	36	68	20
MARGIN										
Entire	11	12	13	14	15	16	17	18	19	20
Denticulate	63	64	58	PE	LU	32	LU	LU	64	PE
NERVES										
1–5	51	52	58	60	62	32	62	LU	64	49
6–11	11	12	35	66	68	16	71	43	19	74
12–21	39	40	13	34	36	16	59	36	40	57
22–	66	AM	34	34	67	66	PR	67	AM	57
STIPULES										
Intact	11	12	13	14	15	16	17	18	19	20
Fibers	66	AM	34	14	37	66	61	67	AM	30
Del. or fug.	54	79	34	34	67	66	PR	67	AM	46
FLOATING LEAVES										
BASE										
Cordate	73	73	AM	69	69	AM	72	73	73	NA
Round. or cun.	45	19	68	69	38	40	42	43	19	NA
Tapering	AL	AL	0	0	0	0	0	0	0	AL
NERVES										
1–10	78	78	0	NA	NA	NO	NA	0	NO	77
11–23	29	12	68	69	38	40	42	43	19	77
24–	AM	68	68	69	38	68	62	68	68	NA

STEM	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*
Stele										
Proto-type	LU	LU	LU	67	68	68	AM	68	73	PR
Trio-type	21	22	23	74	47	50	51	52	78	60
Oblong-type	LU	LU	LU	0	LU	LU	0	LU	0	0
Endodermis										
O-cells	74	51	78	54	54	79	27	56	29	PE
U-cells	62	LU	62	PR	LU	62	0	LU	CO	61
Interlacunar B.										
Present	62	LU	62	67	68	38	AM	68	AM	61
Absent	74	51	78	54	54	79	27	56	29	PE
Subepidermal B.										
Present	62	LU	62	PR	LU	62	0	LU	CO	61
Absent	47	22	52	54	93	55	27	28	56	PE
SUBMERSED LEAVES										
Shape										
Orbicular	PE	PE	0	66	66	AM	66	AM	AM	PE
Ovate	58	58	LU	34	35	68	66	68	AM	57
Oblong	76	76	76	75	76	76	AL	76	AL	PR
Lanceolate	47	22	52	24	25	55	27	28	29	57
Oblanc. or ell.	76	76	76	79	55	55	79	55	79	0
Linear	62	64	33	0	LU	62	NO	64	NO	NA
Base										
Clasping	74	74	AL	46	74	AL	74	AL	AL	57
Not clasping	50	52	23	79	55	26	56	28	29	NA
Apex										
Rounded	49	74	77	46	74	77	74	AL	AL	30
Acutish	47	22	52	54	25	55	27	28	29	PE
Sharp-pointed	LU	64	64	AM	68	68	70	40	70	0
Mucronate	LU	LU	LU	AM	68	68	AM	68	AM	0
Petiole										
Present	LU	64	64	AM	68	68	70	40	45	0
Absent	21	47	50	24	25	26	54	55	79	30
Margin										
Entire	21	22	23	24	25	26	27	28	29	30
Denticulate	58	32	64	PE	58	LU	63	64	NO	PE
Nerves										
1–5	21	22	23	74	47	50	51	52	78	60
6–11	47	22	52	54	25	55	27	28	29	PE
12–21	58	32	64	34	35	68	39	40	70	57
22–	PE	PE	0	34	66	AM	66	AM	AM	57
STIPULES										
Intact	21	22	23	24	25	26	27	28	29	30
Fibers	60	PE	NA	34	66	69	66	AM	AM	30
Del. or fug.	74	74	AL	24	54	79	54	79	79	57
FLOATING LEAVES										
Base										
Cordate	NA	0	NA	AM	AM	69	AM	AM	73	NA
Round. or cun.	62	64	33	AM	68	38	70	40	45	NA
Tapering	AL	AL	AL	AL	AL	AL	AL	AL	AL	0
Nerves										
1–10	77	78	53	AL	AL	77	78	78	78	NA
11–23	50	52	23	79	55	26	56	28	29	NA
24–	62	LU	62	AM	68	38	AM	68	AM	NA

STEM	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*
STELE										
Proto-type	59	LU	LU	67	68	36	67	68	AM	68
Trio-type	62	32	33	PE	58	LU	NA	62	63	64
Oblong-type	LU	LU	LU	0	LU	LU	0	LU	0	LU
ENDODERMIS										
O-cells	0	63	NO	66	66	AM	AM	AM	39	70
U-cells	31	LU	62	PR	LU	59	61	62	0	LU
INTERLACUNAR B.										
Present	31	LU	62	67	68	36	37	38	AM	68
Absent	0	63	NO	66	66	AM	AM	AM	39	70
SUBEPIDERMAL B.										
Present	31	LU	62	PR	LU	59	61	62	0	LU
Absent	LU	32	64	66	35	68	AM	68	39	40
SUBMERSED LEAVES										
SHAPE										
Orbicular	0	PE	0	66	66	AM	AM	AM	66	AM
Ovate	59	58	LU	34	35	36	67	68	66	68
Oblong	59	LU	LU	PR	LU	59	PR	LU	0	LU
Lanceolate	59	32	64	34	35	36	67	68	39	40
Oblanc. or ell.	LU	LU	LU	AM	68	68	AM	68	AM	68
Linear	62	64	33	0	LU	LU	NA	62	NO	64
BASE										
Clasping	PR	PE	0	57	PE	PR	PR	0	PE	0
Not clasping	62	64	33	AM	68	68	69	38	70	40
APEX										
Rounded	61	PE	NA	57	PE	PR	61	NA	PE	0
Acutish	LU	32	64	66	35	68	AM	68	39	40
Sharp-pointed	LU	64	64	AM	68	68	AM	68	70	40
Mucronate	LU	LU	LU	AM	68	68	AM	68	AM	68
PETIOLE										
Present	LU	64	64	AM	68	68	AM	68	70	40
Absent	31	58	62	34	35	36	37	38	66	68
MARGIN										
Entire	31	32	33	34	35	36	37	38	39	40
Denticulate	LU	32	64	PE	58	LU	0	LU	63	64
NERVES										
1–5	62	32	33	PE	58	LU	NA	62	63	64
6–11	LU	32	64	66	35	68	AM	68	39	40
12–21	59	32	64	34	35	36	67	68	39	40
22–	PR	PE	0	34	66	67	67	AM	66	AM
STIPULES										
Intact	31	32	33	34	35	36	37	38	39	40
Fibers	61	PE	NA	34	66	67	37	69	66	AM
Del. or fug.	PR	PE	0	34	66	67	67	AM	66	AM
FLOATING LEAVES										
BASE										
Cordate	NA	0	NA	AM	AM	AM	69	69	AM	AM
Round. or cun.	62	64	33	AM	68	68	69	38	70	40
Tapering	0	0	0	0	0	0	0	0	0	0
NERVES										
1–10	NA	NO	65	0	0	0	NA	NA	NO	NO
11–23	62	64	33	AM	68	68	69	38	70	40
24–	62	LU	62	AM	68	68	69	38	AM	68

STEM	*41*	*42*	*43*	*44*	*45*	*46*	*47*	*48*	*49*	*50*
Stele										
Proto-type	41	71	43	73	73	PR	LU	59	0	LU
Trio-type	LU	62	LU	NA	NO	74	47	76	49	50
Oblong-type	LU	LU	LU	0	0	0	LU	LU	0	LU
Endodermis										
O-cells	CO	CO	73	73	45	74	74	AL	74	AL
U-cells	41	42	71	72	CO	PR	LU	59	NA	62
Interlacunar B.										
Present	59	62	68	69	AM	PR	LU	59	NA	62
Absent	CO	CO	73	73	45	74	74	AL	74	AL
Subepidermal B.										
Present	41	42	71	72	CO	PR	LU	59	NA	62
Absent	LU	LU	68	AM	70	74	47	76	74	76
SUBMERSED LEAVES										
Shape										
Orbicular	0	0	AM	AM	AM	PE	PE	0	PE	0
Ovate	59	LU	68	AM	AM	57	58	59	PE	LU
Oblong	59	LU	LU	0	0	75	76	48	AL	76
Lanceolate	41	71	43	73	45	46	47	48	74	76
Oblanc. or ell.	LU	LU	68	AM	AM	AL	76	76	AL	76
Linear	LU	62	LU	AM	NO	0	LU	LU	NA	62
Base										
Clasping	PR	0	0	0	0	46	74	75	74	AL
Not clasping	71	42	43	44	45	AL	76	76	77	50
Apex										
Rounded	PR	NA	0	NA	0	46	74	75	49	77
Acutish	71	71	43	73	45	74	47	76	74	76
Sharp-pointed	LU	LU	68	AM	70	0	LU	LU	0	LU
Mucronate	LU	LU	68	AM	AM	0	LU	LU	0	LU
Petiole										
Present	71	71	43	73	45	0	LU	LU	0	LU
Absent	59	62	68	69	AM	46	47	48	49	50
Margin										
Entire	41	42	43	44	45	46	47	48	49	50
Denticulate	LU	LU	LU	0	NO	PE	58	LU	PE	LU
Nerves										
1–5	LU	62	LU	NA	NO	74	47	76	49	50
6–11	71	71	43	73	45	74	47	76	74	76
12–21	59	LU	68	AM	70	57	58	59	PE	LU
22–	PR	0	AM	AM	AM	57	PE	PR	PE	0
STIPULES										
Intact	41	42	43	44	45	46	47	48	49	50
Fibers	PR	NA	AM	69	AM	57	PE	PR	60	NA
Del. or fug.	PR	0	AM	AM	AM	46	74	75	74	LU
FLOATING LEAVES										
Base										
Cordate	CO	72	73	14	73	0	0	0	NA	NA
Round. or cun.	41	42	43	44	45	0	LU	LU	NA	62
Tapering	0	0	0	0	0	AL	AL	AL	AL	AL
Nerves										
1–10	0	NA	0	NA	NO	AL	AL	AL	77	77
11–23	71	42	43	44	45	AL	76	76	77	50
24–	LU	62	68	69	AM	0	LU	LU	NA	62

STEM	*51*	*52*	*53*	*54*	*55*	*56*	*57*	*58*	*59*	*60*
STELE										
Proto-type	0	LU	0	AM	68	AM	PR	LU	59	0
Trio-type	51	52	53	74	76	78	PE	58	LU	60
Oblong-type	0	LU	0	0	LU	0	0	LU	LU	0
ENDODERMIS										
O-cells	51	78	78	54	79	56	PE	PE	0	PE
U-cells	0	LU	NA	0	LU	0	PR	LU	59	NA
INTERLACUNAR B.										
Present	0	LU	NA	AM	68	AM	PR	LU	59	NA
Absent	51	78	78	54	79	56	PE	PE	0	PE
SUBEPIDERMAL B.										
Present	0	LU	NA	0	LU	0	PR	LU	59	NA
Absent	51	52	78	54	55	56	PE	58	LU	PE
SUBMERSED LEAVES										
SHAPE										
Orbicular	PE	0	0	66	AM	AM	PE	PE	0	PE
Ovate	PE	LU	0	66	68	AM	57	58	59	PE
Oblong	AL	76	AL	AL	76	AL	PR	LU	59	0
Lanceolate	51	52	78	54	55	56	57	58	59	PE
Oblanc. or ell.	AL	76	AL	79	55	79	0	LU	LU	0
Linear	NO	64	65	0	LU	NO	0	LU	LU	NA
BASE										
Clasping	74	AL	AL	74	AL	AL	57	PE	PR	PE
Not clasping	78	52	53	79	55	56	0	LU	LU	NA
APEX										
Rounded	74	AL	77	74	AL	AL	57	PE	PR	60
Acutish	51	52	78	54	55	56	PE	58	LU	PE
Sharp-pointed	NO	64	NO	AM	68	70	0	LU	LU	0
Mucronate	0	LU	0	AM	68	AM	0	LU	LU	0
PETIOLE										
Present	NO	64	NO	AM	68	70	0	LU	LU	0
Absent	74	76	77	54	55	79	57	58	59	60
MARGIN										
Entire	51	52	53	54	55	56	57	58	59	60
Denticulate	63	64	NO	PE	LU	NO	PE	58	LU	PE
NERVES										
1–5	51	52	53	74	76	78	PE	58	LU	60
6–11	51	52	78	54	55	56	PE	58	LU	PE
12–21	63	64	NO	66	68	70	57	58	59	PE
22-	PE	0	0	66	AM	AM	57	PE	PR	PE
STIPULES										
Intact	51	52	53	54	55	56	57	58	59	60
Fibers	PE	0	NA	AM	AM	AM	57	PE	PR	60
Del. or fug.	74	AL	AL	54	79	79	57	PE	PR	PE
FLOATING LEAVES										
BASE										
Cordate	0	0	NA	66	AM	AM	0	0	0	NA
Round. or cun.	NO	64	65	AM	68	70	0	LU	LU	NA
Tapering	AL	AL	AL	AL	AL	AL	0	0	0	0
NERVES										
1–10	78	78	53	AL	AL	78	0	0	0	NA
11–23	78	52	53	79	55	56	0	LU	LU	NA
24–	0	LU	NA	AM	68	AM	0	LU	LU	NA

STEM	*61*	*62*	*63*	*64*	*65*	*66*	*67*	*68*	*69*	*70*
Stele										
Proto-type	PR	LU	0	LU	0	AM	67	68	AM	AM
Trio-type	NA	62	63	64	65	PE	0	LU	NA	NO
Oblong-type	0	LU	0	LU	0	0	0	LU	0	0
Endodermis										
O-cells	0	0	63	NO	NO	66	AM	AM	AM	70
U-cells	61	62	0	LU	NA	0	PR	LU	NA	0
Interlacunar B.										
Present	61	62	0	LU	NA	AM	67	68	69	AM
Absent	0	0	63	NO	NO	66	AM	AM	AM	70
Subepidermal B.										
Present	61	61	0	LU	NA	0	PR	LU	NA	0
Absent	0	LU	63	64	NO	66	AM	68	AM	70
SUBMERSED LEAVES										
Shape										
Orbicular	0	0	PE	0	0	66	AM	AM	AM	AM
Ovate	PR	LU	PE	LU	0	66	67	68	AM	AM
Oblong	PR	LU	0	LU	0	0	PR	LU	0	0
Lanceolate	PR	LU	63	64	NO	66	67	68	AM	70
Oblanc. or ell.	0	LU	0	LU	0	AM	AM	68	AM	AM
Linear	NA	62	NO	64	65	0	0	LU	NA	NO
Base										
Clasping	PR	0	PE	0	0	PE	PR	0	0	0
Not clasping	NA	62	NO	64	65	AM	AM	68	69	70
Apex										
Rounded	61	NA	PE	0	NA	PE	PR	0	NA	0
Acutish	0	LU	63	64	NO	66	AM	68	AM	70
Sharp-pointed	0	LU	NO	64	NO	AM	AM	68	AM	70
Mucronate	0	LU	0	LU	0	AM	AM	68	AM	AM
Petiole										
Present	0	LU	NO	64	NO	AM	AM	68	AM	70
Absent	61	62	PE	LU	NA	66	67	68	69	AM
Margin										
Entire	61	62	63	64	65	66	67	68	69	70
Denticulate	0	LU	63	64	NO	PE	0	LU	0	NO
Nerves										
1–5	NA	62	63	64	65	PE	0	LU	NA	NO
6–11	0	LU	63	64	NO	66	AM	68	AM	70
12–21	PR	LU	63	64	NO	66	67	68	AM	70
22–	PR	0	PE	0	0	66	67	AM	AM	AM
STIPULES										
Intact	61	62	63	64	65	66	67	68	69	70
Fibers	61	NA	PE	0	NA	66	67	AM	69	AM
Del. or fug.	PR	0	PE	0	0	66	67	AM	AM	AM
FLOATING LEAVES										
Base										
Cordate	NA	NA	0	0	NA	AM	AM	AM	69	AM
Round. or cun.	NA	62	NO	64	65	AM	AM	68	69	70
Tapering	0	0	0	0	0	0	0	0	0	0
Nerves										
1–10	NA	NA	NO	NO	65	0	0	0	NA	NO
11–23	NA	62	NO	64	65	AM	AM	68	69	70
24–	NA	62	0	LU	NA	AM	AM	68	69	AM

STEM	*71*	*72*	*73*	*74*	*75*	*76*	*77*	*78*	*79*
STELE									
Proto-type	71	CO	73	0	PR	LU	0	0	AM
Trio-type	LU	NA	0	74	AL	76	77	78	AL
Oblong-type	LU	0	0	0	0	LU	0	0	0
ENDODERMIS									
O-cells	CO	CO	73	74	AL	AL	AL	78	79
U-cells	71	72	CO	0	PR	LU	NA	0	0
INTERLACUNAR B.									
Present	LU	NA	AM	0	PR	LU	NA	0	AM
Absent	CO	CO	73	74	AL	AL	AL	78	79
SUBEPIDERMAL B.									
Present	71	72	CO	0	PR	LU	NA	0	0
Absent	LU	0	AM	74	AL	76	AL	78	79
SUBMERSED LEAVES									
SHAPE									
Orbicular	0	0	AM	PE	0	0	0	0	AM
Ovate	LU	0	AM	PE	PR	LU	0	0	AM
Oblong	LU	0	0	AL	75	76	AL	AL	AL
Lanceolate	71	CO	73	74	75	76	AL	78	79
Oblanc. or ell.	LU	0	AM	AL	AL	76	AL	AL	79
Linear	LU	NA	0	0	0	LU	NA	NO	0
BASE									
Clasping	0	0	0	74	75	AL	AL	AL	AL
Not clasping	71	72	73	AL	AL	76	77	78	79
APEX									
Rounded	0	NA	0	74	75	AL	77	AL	AL
Acutish	71	CO	73	74	AL	76	AL	78	79
Sharp-pointed	LU	0	AM	0	0	LU	0	NO	AM
Mucronate	LU	0	AM	0	0	LU	0	0	AM
PETIOLE									
Present	71	CO	73	0	0	LU	0	NO	AM
Absent	LU	NA	AM	74	75	76	77	AL	79
MARGIN									
Entire	71	72	73	74	75	76	77	78	79
Denticulate	LU	0	0	PE	0	LU	0	NO	0
NERVES									
1–5	LU	NA	0	74	AL	76	77	78	AL
6–11	71	CO	73	74	AL	76	AL	78	79
12–21	LU	0	AM	PE	PR	LU	0	NO	AM
22–	0	0	AM	PE	PR	0	0	0	AM
STIPULES									
Intact	71	72	73	74	75	76	77	78	79
Fibers	0	NA	AM	PE	PR	0	NA	0	AM
Del. or fug.	0	0	AM	74	75	AL	AL	AL	79
FLOATING LEAVES									
BASE									
Cordate	CO	72	73	0	0	0	NA	0	AM
Round. or cun.	71	72	73	0	0	LU	NA	NO	AM
Tapering	0	0	0	AL	AL	AL	AL	AL	AL
NERVES									
1–10	0	NA	0	AL	AL	AL	77	78	AL
11–23	71	72	73	AL	AL	76	77	78	79
24–	LU	NA	AM	0	0	LU	NA	0	AM

The numbers used in the selective key and the subsections they represent are as follows:

1.	AL	CO	AM	NO	NA	LU	PR	PE	41.	CO	LU	PR	
2.	AL	CO	AM	NO	LU	PR	PE		42.	CO	NA	LU	
3.	AL	AM	NA	LU	PR	PE			43.	CO	AM	LU	
4.	AL	CO	AM	NO	LU	PE			44.	CO	AM	NA	
5.	AL	CO	AM	NO	NA	LU			45.	CO	AM	NO	
6.	AM	NO	LU	PR	PE				46.	AL	PR	PE	
7.	CO	AM	NO	NA	LU				47.	AL	LU	PE	
8.	AL	NO	NA	LU	PE				48.	AL	LU	PR	
9.	AL	AM	LU	PR	PE				49.	AL	NA	PE	
10.	AL	AM	NO	LU	PE				50.	AL	NA	LU	
11.	AL	CO	AM	NO	PE				51.	AL	NO	PE	
12.	AL	CO	AM	NO	LU				52.	AL	NO	LU	
13.	AM	LU	PR	PE					53.	AL	NO	NA	
14.	AM	NA	PR	PE					54.	AL	AM	PE	
15.	AM	NA	LU	PR					55.	AL	AM	LU	
16.	AM	NO	LU	PE					56.	AL	AM	NO	
17.	CO	NA	LU	PR					57.	PR	PE		
18.	CO	AM	LU	PR					58.	LU	PE		
19.	CO	AM	NO	LU					59.	LU	PR		
20.	AL	NA	PR	PE					60.	NA	PE		
21.	AL	NA	LU	PE					61.	NA	PR		
22.	AL	NO	LU	PE					62.	NA	LU		
23.	AL	NO	NA	LU					63.	NO	PE		
24.	AL	AM	PR	PE					64.	NO	LU		
25.	AL	AM	LU	PE					65.	NO	NA		
26.	AL	AM	NA	LU					66.	AM	PE		
27.	AL	AM	NO	PE					67.	AM	PR		
28.	AL	AM	NO	LU					68.	AM	LU		
29.	AL	CO	AM	NO					69.	AM	NA		
30.	NA	PR	PE						70.	AM	NO		
31.	NA	LU	PR						71.	CO	LU		
32.	NO	LU	PE						72.	CO	NA		
33.	NO	NA	LU						73.	CO	AM		
34.	AM	PR	PE						74.	AL	PE		
35.	AM	LU	PE						75.	AL	PR		
36.	AM	LU	PR						76.	AL	LU		
37.	AM	NA	PR						77.	AL	NA		
38.	AM	NA	LU						78.	AL	NO		
39.	AM	NO	PE						79.	AL	AM		
40.	AM	NO	LU										

Synopsis of Species

1. P. crispus Linnaeus

Rhizome about same thickness as stem, buff or reddish, unspotted. Stem laterally compressed, simple or branched, .5–2 (2.5) mm. in greatest diameter; stele of the oblong-type pattern with but 1 central bundle and 1 lateral bundle on each side; endodermis of O-cells; interlacunar bundles absent; subepidermal bundles absent; pseudo-hypodermis 1 cell thick. Leaves all submersed, linear-oblong to linear-oblanceolate, principal ones (3–) 5–8 (–10) cm. long, (.2–) .5–.8 (–1) cm. wide, semi-clasping at base, broadly rounded at apex; nerves 3–7; lacunae of 1 or 2

rows along the midrib; margins finely and irregularly dentate. STIPULES .5–1 cm. long, slightly adnate at base, upper part fraying early, leaving the papery or shreddy bases. PEDUNCLES terete, about same thickness as greatest diameter of stem, 2–5 (–7) cm. long. SPIKES in anthesis compact or moniliform, of 3–5 whorls of flowers; in fruit 1–2 cm. long, 1–1.3 cm. thick. Flowers sessile or on pedicels up to .4 mm. long; sepaloid connectives orbicular, (1.2–) 1.5–1.9 (–2.1) mm. wide, claws .3–.9 mm. long; anthers .7–1.1 (–1.3) mm. long. FRUITS ovate, (2–) 2.5–3 (–3.6) mm. long (excluding beak), (1.6–) 2–2.5 (–2.8) mm. wide; keels obtuse but prominent, dorsal one strongly developed below and with a small projecting tooth near the base; beak prominent, straight or incurved, 2–3 mm. long; exocarp rather smooth, greenish or brownish; endocarp loop solid and near the base; apex of seed pointing toward the basal end. WINTER BUDS hard and horny, 1–2 cm. thick.

P. crispus L., Sp. Pl. **1:** 126 (1753); C. & S., Linnaea **2:** 186 (1827); Morong, Mem. Torr. Club **3:** no. 2: 36 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 97 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 21 (1909); Hagstr., Crit. Res. Pot. 58 (1916).

Ponds and streams. Southern Quebec to Virginia, west to Missouri, also in California. MAP 1. Europe, Asia, Africa, Australia. The following are representative: QUEBEC: Ile Sainte-Therèse, St.-Jean Co., *Victorin & Rolland 45189* and *49141*. VERMONT: tributary of Lake Champlain, Charlotte, July 8–11, 1911, *Dutton;* Charlotte, Chittenden Co., July 7, 1911, *Kent* (N, mixed with *P. Richardsonii*). MASSACHUSETTS: Spy P., Arlington, Middlesex Co., Sept. 21, 1880, herb. *C. E. Faxon;* near Fresh Pond, Cambridge, Middlesex Co., *Fernald & Weatherby, Plantae Exsiccatae Grayanae 111;* Cambridge Bot. Gard., 1864, *J. T. Rothrock;* Sudbury R., Concord, Middlesex Co., *Ogden 1502*. CONNECTICUT: Housatonic R., Derby, *E. H. Eames 11502;* Lake Zoar, Housatonic R., Southbury, New Haven Co., *E. H. Eames 11485*. NEW YORK: Lake Ontario, southwest of Chaumont, Jefferson Co., *Fernald, Wiegand & Eames 14089;* Pierrepont P., Woodville, Jefferson Co., *House 10069;* north end of Cossayuna L., Washington Co., *Muenscher & Lindsey 2739;* abandoned canal, Montezuma, Cayuga Co., *Eames & Wiegand 14535;* pool at Eldridge L., Chemung Co., upper waters of the Susquehanna, *Lucy 10814;* Renwick Flats, Ithaca, Tompkins Co., *Wiegand 11182;* Old Ice Pond, Ithaca, *R. Jones 7471;* Float Bridge, Rochester, *Baxter 5388;* Lake Washington Park, Albany, Albany Co., June 14, 1910, *S. H. Burnham*. NEW JERSEY: tide ditches, Camden, May 5, 1866, *C. F. Parker;* Camden, June 1879, *I. C. Martindale;* Clifton, *Nash 786;* Cedar Brook, Plainfield, May 1879, *Frank Tweedy*. PENNSYLVANIA: Conestoga, near Lancaster, June 19, 1861, *T. C. Porter;* Juaniata R., Huntingdon

Co., Aug. 1864, *T. C. Porter;* Lehigh R., Easton, July 11, 1868, *T. C. Porter;* Sharon, July 7, 1886, *F. T. Aschman;* outlet of pond on tributary to Pennypack Creek, Willow Grove, Montgomery Co., *Adams & Tash 512.* Delaware: Wilmington, 1863, *Wm. M. Canby;* Wilmington, June 1879, *A. Commons;* Wooddale, June 24, 1879, *A. Commons;* Faulkland, New Castle Co., June 1879, *A. Commons;* Greenbank, Oct. 16, 1879, *A. Commons.* Maryland: Spesutie Island, May 27, 1879, *J. D. Smith;* Cleft Island, Great Falls, *McAtee 2953.* District of Columbia: Fish Ponds, *Shull 15;* Georgetown, *VanEseltine & Moseley 201.* West Virginia: Fish Hatchery, White Sulphur Springs, Greenbrier Co., *Berkley 1215.* Virginia: Fourmile Run, Chesapeake Bay Region, *Shull 465;* near Four-mile Run, near Alexandria, *Blake 9472;* 1 mile s. w. of Williamsburg, *Grimes 3255;* Dyke, Fairfax Co., *Metcalf & Sperry 1631;* Claremont Wharf, Surrey Co., *Fernald & Long 7747.* Ontario: Toronto, *Scott 16439;* pool above Niagara Falls, *John Macoun 26830;* Kingston, June 15, 1901, *J. Fowler;* Sault Sainte Marie, Algoma Co., *Fassett 14746.* Michigan: Muskegon Lake, Muskegon State Park, 4½ mi. w. of Muskegon, Muskegon Co., *Hermann 8647;* Kalamazoo R., Kalamazoo Co., Aug. 15, 1938, *W. G. Erwin.* Reported from Ottawa Co., and Van Buren Co. by Oosting.[1] Indiana: Wolf L., June 7, 1913, *E. D. Hull;* east side of Wolf Lake, just w. of Whiting, Lake Co., *Deam 56607.* Illinois: Wolf L., Chicago, June 10, 1911, *E. E. Sherff;* Stony Island, Chicago, Cook Co., *Steyermark 4227;* Lake Nippersink, according to Tehon, Torreya **29:** 42 (1929), specimen not seen. Minnesota: Lake Minnetonka, *Keck & Stilwill 428* and *430;* Mississippi R., Wabasha Co., *Keck & Stevens 335;* Mississippi bottoms, below Winona, Aug. 6, 1931, *H. J. Oosting.* Missouri: Neosho, *Metcalf 948;* Blue Spring L. and Osage L., formed by Blue Springs, 2 mi. s. e. of Bourbon, Crawford Co., *Steyermark 16313.* South Dakota: Edmunds Co., July 1896, *D. Griffiths* (specimen in Herb. Brooklyn Bot. Gard., not seen; see Torreya **29:** 43 (1929)). Wyoming: Lakes Swastika and Irene, Medicine Bow mountains (specimens not seen; see Torreya **32:** 5 (1932)). California: cultivated at Pomona College, the plants brought from Santa Ana R., near Corona, "only known station in California," San Bernardino Co., *Parish 19248;* pond in botany lathhouse of Pomona College, planted by Johnston from Santa Ana R., *Munz 2785.* Oregon: near Silvies, Aug. 19, 1901, *Griffiths & Morris* (specimen in Herb. Brooklyn Bot. Gard., not seen; see Torreya **29:** 43 (1929)).

P. crispus is distinct from all other species of *Potamogeton* found in North America, and should never be confused with any

[1] Henry J. Oosting, Pap. Mich. Acad. Sci., Arts and Letters **15**: 165 (1932).

of them, for it is the only one with leaf-margins having a dentatation evident to the unaided eye. Its fruits are distinctive in having long (2–3 mm.) beaks. Fruits are usually not produced when the plant grows in deep water, but in shallow, warm pools it fruits freely. The winter-buds are especially distinctive, being large (1–2 cm. thick) and hard and horny. This species is not native to the Western Hemisphere but is introduced into North America where in some places it is growing profusely and acting as a weed. It evidently arrived here rather early for Pursh in 1814 reports it from "Canada to Virginia."[1] Bennett says, "The oldest dated American specimen I can find in England is in Mr. Cosmo Melvill's herbarium, 'Philadelphia, 1841–2, Gavin Watson & Kilvington.' One from Delaware in the British Museum Herbarium is probably older: it was collected by R. Eglesfeld Griffith of Philadelphia . . . "[2] In 1913, Hull[3] reports it as being abundant and acting as a weed around Chicago in waters connected to Lake Michigan. He believed the arrival of the plant to that region to have been quite recent. Tehon[4] believes the westward spread of the species in North America to be due to migrating water birds and suggests that its introduction to North America may be due to the same agents.

2. P. ALPINUS Balbis (American varieties)

RHIZOME about same thickness as stem, branching and creeping, pinkish, not spotted. STEM terete, 1–2 mm. in diameter, simple below, rarely branched above, often pressing very flat; stele with the trio-type pattern, the phloem on the inner face of the trio-bundle usually appearing as two distinct patches; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudo-hypodermis absent. SUBMERSED LEAVES (excluding transition-leaves) thin, delicate, translucent, oblong-linear to linear-lanceolate, 4.5–18 cm. long, 1–2 cm. broad, usually with 7 prominent nerves, sometimes also having 2 to 6 less prominent or incomplete ones, sessile and slightly clasping, apex obtuse or rarely acutish but never sharp-pointed; margin entire; lacunae along the midrib of rectangular cells, 4–6 rows near the base, 2 or 3 rows at the middle and 0–2 rows near the apex. FLOATING LEAVES thin, translucent, often poorly developed or absent, blades elliptical or oblanceolate to obovate or oblong-linear,

[1] Frederick Pursh, Fl. Am. Sept. 120 (1814).
[2] Arthur Bennett, Journ. Bot. **39**: 201 (1901).
[3] E. D. Hull, RHODORA **15**: 171 (1913).
[4] L. R. Tehon, Torreya **29**: 42–46 (1929).

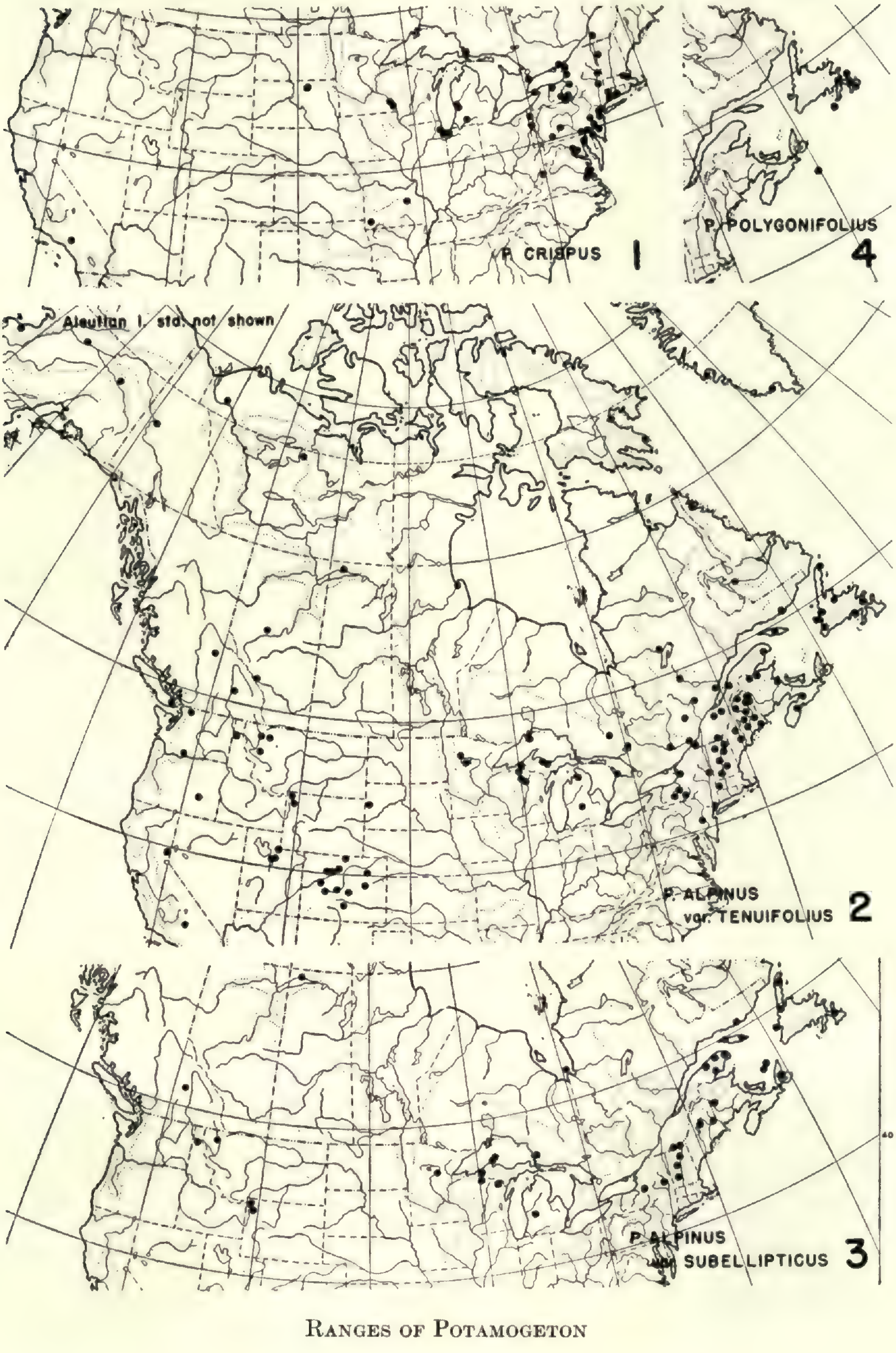
4–6.5 cm. long, 1–2 cm. wide, gradually tapering with no sharp distinction into a petiole 1–3 cm. long, with (7–) 9–13 (–15) prominent nerves, outer pair meeting the midrib a short distance back from the obtuse apex; lacunae along midrib of elongate cells near base and of oval cells near the middle, entire blade more or less lacunate with rounded lacunae. Stipules of submersed leaves thin, membranous, oblong, obtuse, faintly 2-keeled with 3 lateral nerves on each side, which meet the keel-nerves back from the apex, (1.2–) 1.5–2.5 (–4) cm. long, 2–8 mm. broad; those of the transitional and floating leaves similar but broader (up to 1 cm.) and with more nerves (15), some also between the more prominent keel-nerves. Peduncles same thickness as the stem, 3–10 (–16) cm. long. Spikes in anthesis more or less moniliform, especially at the base, with 5–9 whorls of flowers; in fruit cylindric and crowded, 1.5–3.5 cm. long, .8–1 cm. thick. Flowers on short pedicels .5–1 mm. long; sepaloid connectives orbicular to reniform, blades 1.2–2 mm. wide, claws .7–.8 mm. long; anthers oblong, .6–1 mm. long. Fruits mostly obovate, (2.5–) 3–3.5 mm. long (excluding beak), (1.7–) 2–2.4 mm. wide, lateral keels none or very low, dorsal keel thin, usually prominent and well developed upward, beak lateral, short and curved toward the back; exocarp smooth, pitted when immature, tawny-olive; endocarp with keels rounded, beak linear, 1–1.3 mm. long, curved toward the back, loop solid; apex of seed pointing toward basal end. Whole plant and especially the rachis of the spike usually suffused with red.

Two varieties in North America:

Submersed leaves oblong-linear to linear-lanceolate, 7–25 cm. long, usually more than 8 times as long as broad, tapering to an obtuse or acutish apex . . . . . 2a. var. *tenuifolius*.
Submersed leaves oblong to ovate-oblong, 4–10 cm. long, usually less than 8 times as long as broad, apex rounded and sometimes slightly cucullate . . . . . 2b. var. *subellipticus*.

2a. P. alpinus Balbis var. **tenuifolius** (Raf.), comb. nov.

P. tenuifolius Raf., Med. Repos. hex. 3, **2:** 409 (1811); Fernald, Rhodora **33:** 210 (1931). *P. lucens* sensu Michx. Fl. Bor.-Am. **1:** 101 (1803), in part, not L. (1753). *P. microstachys* Wolfg. in Schultes & Schultes, Mant. **3:** 360 (1827). *P. rufescens* "forma *angustifolia*" from Unalaska, C. & S., Linnaea **2:** 211 (1827). *P. obrutus* Wood, Cl.-Bk. ed. **2:** 525 (1847). *P. lucens* var.? *fluitans* (Roth) Gray, Man. ed. **2:** 435 (1856), as to synonyms *P. rufescens* Schrad. and *P. obrutus* Wood, not *P. fluitans* Roth. *P. alpinus* sensu Morong, Mem. Torr. Club **3:** no. 2: 19 (1893), in large part; sensu Graebn. in Engler, Pflanzenr. **4:** fam. 11: 70 (1907), as to Am. plant in large part; sensu Taylor, N. Am.



RANGES OF POTAMOGETON

Fl. **17:** pt. 1: 19 (1909) in large part; sensu Hagstr., Crit. Res. Pot. 141 (1916), as to Am. plant, in large part. *P. alpinus* proles *microstachys* (Wolfg.) Graebn. in Engler, Pflanzenr. **4:** fam. 11: 72 (1907). *P. montanense* Gandog., Bull. Soc. Bot. France **66:** 304 (1920). *P. microstachys* var. *typicus* Fernald, Rhodora **32:** 80 (1930). *P. alpinus* subsp. *tenuifolius* (Raf.) Hultén, Fl. Aleut. Is. 65 (1937) and Fl. Alaska and Yukon 98 (1941). *P. rufescens* sensu Am. authors, in large part, not Schrad.

Streams and cold ponds, southwestern Greenland, Labrador, and Hudson Bay to Alaska and the Aleutian Islands, south to Newfoundland, Nova Scotia, western Massachusetts and Pennsylvania, Colorado and California. Map 2. The following, selected from many specimens, are representative: Greenland: Itivnera, 64° 22′ N., Godthaab Fjord, Aug. 19, 1931, *M. P. Porsild;* Qagssiarssuk, 60° 53′ N., Igaliko-Fjord, Aug. 5, 1925, *A. E. & M. P. Porsild;* Igaliko, July 23, 1888, *L. Kolderup Rosenvinge.* Labrador: Rama, *A. Stecker* 332; Seal L., n. Lab., *Spreadborough 16429;* Grand Falls of Hamilton R., *M. T. Doutt 3296.* Newfoundland: Little Quirpon, Quirpon Harbor, *Wiegand & Hotchkiss 27337;* Highlands Brook above pond, Crabbes, *R. B. Kennedy 81;* shores of Conception Bay, Carbonear, *Fernald & Wiegand 4473;* Grand Falls, Valley of Exploits River, *Fernald, Wiegand & Darlington 4474;* Lookout Mountain, West Arm (South Arm of charts), Bonne Bay, *Fernald, Long & Fogg 1207;* Grand L., Bay of Islands, *A. C. Waghorne 6;* St. Georges P., between Bay St. George and Bay of Islands, *Fernald & Wiegand 2443* (approaching var. *subellipticus*). Quebec: Natashquan, Saguenay Co., *St. John 90083 & 90084;* Lac Duguay, Newport, Gaspé Co., *Proulx 58;* Riv. Mistassin, (Michaux Herb., Paris Museum, as *P. lucens,* type of *P. tenuifolius* Raf., as to plant on right); Lac William, Mégantic Co., *Victorin 11162;* shallow lagoon, head of Sargents Bay, Lake Memphremagog, Aug. 3, 1903, *Churchill;* Bolton Center, Sherbrooke Co., *Pease 26709;* La Sarre, Abitibi, *Louis-Marie 313;* lac tourbeux, Ville Montel, Abitibi Region, *Victorin, Rolland & Meilleur 43730.* Anticosti: Anticosti I., *Victorin & Rolland 27630.* New Brunswick: Junction of Restigouche and Matapedia Rivers, *Rousseau 32332;* Bass R., Nepisiquit, July 30, 1873, *J. Fowler;* St. John R., Connors, *Pease 2907.* Nova Scotia: Truro, Colchester Co., *Bean & White 22963;* Mahone Bay, Hamilton *64010.* Maine: White's Brook, Seven Islands, T. 13, R. 14 & 15, valley of the St. John R., Aroostook Co., *St. John & Nichols 2104;* St. John R., Madawaska, *Fernald 117;* Piscataquis R., Dover, Aug. 27, 1894, *Fernald;* Mattagodus Stream, Tredwell School, Prentiss, Penobscot Co., *Steinmetz 323;* Haley Pond, Rangeley, Franklin Co., Sept. 1, 1894, *K. Furbish;* Pembroke, Washington Co., *Fernald 1622;* Sydney, Kennebec

Co., *Fernald & Long 12388.* NEW HAMPSHIRE: Colebrook, Coös Co., *Pease & Fernald 17024* (app. v. *subellipticus*); Horseshoe P., Northumberland, Coös Co., *Pease 17270* (app. v. *subellipticus*); Cherry P., Jefferson, Coös Co., July 1829, *J. W. Robbins;* bayou of the Connecticut R., Hanover, July 12, 1910, *E. F. Williams* (flaccid form). VERMONT: Harvey's P., W. Barnet, Sept. 7, 1885, *F. Blanchard;* Windsor, Sept. 6, 1881, *Geo. Leland;* "e flumine Passumpsic," *A. Wood* (original collection of *P. obrutus*). MASSACHUSETTS: Richmond, Sept. 19, 1864, *Robbins.* NEW YORK: Preble, Cortland Co., July 31, 1886, *Dudley;* Paradox L., *Muenscher & Lindsey 2712;* Black R., Dexter, Jefferson Co., *Fernald, Wiegand & Eames 14082;* n. of R. R. bridge, Cayuga, Cayuga Co., Oct. 1886, *W. R. Dudley* (mixed with *P. illinoensis* in US); Oxford, June 30, 1886, *F. V. Coville.* PENNSYLVANIA: near Easton, Aug. 4, 1869, *Thos. C. Porter.* ONTARIO: Cross L. Portage, Temagami Forest Reserve, *Krotkov 5142* (app. v. *subellipticus*); Current R., July 20, 1869, *John Macoun;* "Bruce Co., Peninsula," 1871, *John Macoun.* MICHIGAN: Isle Royale, *W. S. Cooper*, no. "254 in part"; Dead R., Marquette, *C. F. Wheeler 26;* 3 mi. n. e. of Watersmeet, Gogebic Co., *Bessey B & D 2781;* Beaver R., Petoskey, July 2, 1878, *E. J. Hill;* Alma, Aug. 11, 1893, *C. A. Davis;* Chatham, *C. F. Wheeler 90.* WISCONSIN: White Sand L., Vilas Co., Aug. 11, 1930, *J. P. E. Morrison;* Minocqua, Oneida Co., *Fassett 5343;* between McNaughton and Rhinelander on Wis. R., *L. S. Cheney 1501.* MANITOBA: Churchill, *Polunin 1976, 1977, & 2062.* MINNESOTA: Lake Kilpatrick, Cass Co., Aug. 1893, *C. H. Bullard* (app. v. *subellipticus*); n. end of Squaw L., Clearwater Co., *Moyle 894* (app. v. *subellipticus*); SOUTH DAKOTA: Boulder Creek, Boulder Canyon, Lawrence Co., *Over 13817* (app. v. *subellipticus*). MACKENZIE: Setidgi L., 68° 28′ N., 132° 20′ W., Aug. 21, *A. E. & R. T. Porsild;* McTavish Bay, Great Bear L., 66° 23′ N., 117° 40′ W., *A. E. & R. T. Porsild.* SASKATCHEWAN: Cornwall Bay, L. Athabasca, 59° 27′ 30″ N., 108° 27′ 30″ W., *Raup 6618, 6621, & 6622.* Archibald R., vicinity of Wolverine Pt., L. Athabasca, 59° 9′ N., 108° 25′ W., *Raup 6741.* ALBERTA: Slave Lake Dist., *Brinkman 4541;* Vermillion Lakes, Banff, *Macoun 4365.* MONTANA: Medicine Lakes, *Maguire 472;* Swift Current Creek, *Maguire 474;* Trout Lake, *Maguire & Piranian 5442;* Rost L., Big Fork, *Whitford 258;* Swift Current Creek, below Lake McDermott, Glacier Nat'l Park, *Standley 16855;* Swan R. at Elbow (Lindberg) L., Mission Range, Missoula Co., *G. B. & R. P. Rossbach 16.* IDAHO: Kootenai Co., Sept. 1887, *J. H. Sandberg.* WYOMING: Shoshone Lake, Yellowstone Nat'l Park, *Rydberg & Bessey 3724* (TYPE no. of *P. montanense* Gandog.) *& 3725;* Heart Lake Creek, Yellowstone region, Sept. 3, 1878, *C. Richardson* (mixed with v. *subel-*

lipticus in US). Colorado: Lake Eldora, Boulder Co., *Clokey 3118;* Georgetown, *M. E. Jones 734;* Walton Creek, Routt Co., July 1891, *A. Eastwood;* vicinity of Twin Lakes, July–Aug., 1902, *C. Juday;* Seven Lakes, *F. E. & E. S. Clements 491;* Grand Lake, *Shear & Bessey 5328;* Howe P. O., Larimer Co., *Osterhout 2885;* Tomichi R., Parlin, Gunnison Co., Aug. 20, 1901, *Benj. H. Smith.* Utah: Clayton Peak, Wasatch Mts., Aug. 12–26, 1903, *S. G. Stokes;* Twin Lakes, Alta, Wasatch Mts., *M. E. Jones 1297;* Silver L. at Brighton, Big Cottonwood Canyon, Salt Lake Co., *Maguire & Richards 13156;* Bridger L., Uinta Mts., Summit Co., *Rollins 2319;* Brighton, *M. E. Jones 6606.* California: North Fork of Kings R., *Hall & Chandler 563*, region of Kaweah Peaks, Funston's Meadows, Tulare Co., *Dudley 2201;* Webber L., Sierra Co., Aug. 3, 1894, *Dudley;* Silver Valley, Alpine Co., *Brewer 1978.* Oregon: in a warm spring, Harney Valley, June 10, 1885, *T. Howell* (mixed with *P. illinoensis*). Washington: Trout Creek, w. Klickitat Co., *Suksdorf 2172;* Falcon Valley, Mt. Adams, Sept. 1879, *Suksdorf;* Baker L., Whatcom Co., *Muenscher 7657a & 7658.* British Columbia: Kicking Horse L., Rocky Mts., Aug. 17, 1890, *John Macoun 4162;* Revelstoke, *John Macoun 4163;* Barkerville, *McCabe 43;* Nanaimo, Vancouver I., *John Macoun 4167 & 4167a.* Yukon: Bonanza Creek, *John Macoun 78320 & 78321.* Alaska: Goldstream Cr. and Pedro Dome, 65° 0′ N., 147° 30′ W., *A. E. & R. T. Porsild 114;* Buckland R., 65° 55′ N., 161° 0′ W., *A. E. & R. T. Porsild 1496;* Afognak L., Afognak Island, Shelikof Strait off Alaska Pen., Aug. 1931, *W. H. Rich;* Kodiak Island, *Trelease 2870 & 2871;* Shumagin Islands, *Saunders 2869;* False Pass, Unimak Island, Aleutian Islands, *Eyerdam 2141;* Unalaska (type-locality of *P. microstachys*), *Van Dyke 202*, also *Eyerdam 2360*, and *Hultén 7573;* Seldovia, *Piper 4426;* Kukak Bay, Alaska Pen., *Coville & Kearney 1564;* Olga Bay, Kodiak Island, *E. H. & H. B. Looff 1501.*

2b. P. alpinus Balbis var. **subellipticus** (Fernald), comb. nov.

P. microstachys var. *subellipticus* Fernald, Rhodora **32:** 82 (1930). *P. alpinus*, sensu Morong Mem. Torr. Club **3:** no. 2: 19 (1893), in small part; sensu Graebn., in Engler, Pflanzenr. **4:** fam. 11: 70 (1907), as to N. Am. plant in small part; sensu Taylor, N. Am. Fl. **17:** pt. 1: 19 (1909), in small part; sensu Hagstr., Crit. Res. Pot. 141 (1916), as to Am. plant in small part. *P. tenuifolius* var. *subellipticus* Fernald, Rhodora **33:** 211 (1931).

Shallow pools and slow streams, Newfoundland, south to southern Vermont and eastern New York, sparingly westward to Wyoming and Montana. Map. 3. The following are referred here: Newfoundland: Salmonier R., 1931, *Agnes Ayre;* Flower Cove, Straits of Belle Isle, *Fernald & Long 26221*, also *Hotchkiss*

27338; Stephenville, region of Bay St. George, *Fernald, Wiegand & Kittredge 2442;* Port à Port, *Mackenzie & Griscom 10047.* QUEBEC: Ile à la Proie, Archipel de Mingan, *Victorin & Rolland 20462;* Locked Camp, Rivière Cap Chat, Matane Co., *Victorin, Rolland & Jacques 44451;* Maria, Bonaventure Co., *Victorin, Rolland & Jacques 33315;* between Baldé and the Baie des Chaleurs, Bonaventure R., Bonaventure Co., *Collins, Fernald & Pease 5911;* Georgeville, *Pease 1919;* Charlton Island, about 52° N., 79° 30′ W., James Bay, *A. E. Porsild 4296;* Lac Philippe, Ladysmith, Pontiac Co., *Gauthier 2446.* ANTICOSTI: Rivière Sainte-Marie, *Victorin & Rolland 25938;* Rivière au Saumon, *Victorin, Rolland & Louis-Marie 20467.* MAGDALEN ISLANDS: East Cape and East Point, Coffin Island, *Fernald, Long & St. John 6766,* (TYPE in Gray Herb.); Ile de Havre-au-Ber, *Victorin & Rolland 9923.* NEW BRUNSWICK: Eel R., Dalhousie, *Svenson & Fassett 3028.* NOVA SCOTIA: Baddeck Bay, Victoria Co., *Fernald & Long 19687.* MAINE: Houlton, Aroostook Co., 1881, *K. Furbish,* also *Fernald & Long 12387;* Foxcroft, Piscataquis Co., Sept. 5, 1894, Sept. 15, 1894 & Aug. 31, 1896, *Fernald.* VERMONT: Little Leech Pond, Averill, Essex Co., *Eggleston 1656;* Willoughby, Orleans Co., Aug. 4 & 11, 1881, *E. Faxon;* "Nigger" P., Westmore, Orleans Co., *Eames & Godfrey 9334;* West Burke, *Redfield 8014;* Evart's P., Windsor, Aug. 27, 1933, *Weatherby & Griscom.* NEW YORK: Minerva Brook, east of Minerva, Essex Co., *House 15182;* Niagara Falls, Aug. 21, 1886, *Morong;* Paradox L., Essex Co., *Killip 12605* (mixed with *P. amplifolius* in US). ONTARIO: Howdenvale, *Watson 3144 & 3145;* River Trent, *John Macoun 4168;* Batchawana Falls, Algoma Dist., *Taylor et al. 294.* MICHIGAN: Eagle Harbor, Keweenaw Pen., 1863, *Robbins;* North Cliff, Keweenaw Co., Aug. 1, 1888, *O. A. Farwell;* west branch Ontonagon R., Tenderfoot L., Gogebic Co., *Hotchkiss & Koehler 4349.* WISCONSIN: Three Lakes, Oneida Co., Aug. 5, 1918, *R. Hoffman;* n. w. end of Big Arbor Vitae L., Vilas Co., *Hotchkiss & Martin 4460.* MINNESOTA: Lake Kilpatrick, Cass Co., Aug. 1893, *C. A. Ballard;* Gull L., Cass Co., Aug. 1893, *A. P. Anderson.* SASKATCHEWAN: Archibald R., vicinity of Wolverine Pt., L. Athabasca, about 59° 9′ N., 108° 25′ W., *Raup 6742.* MONTANA: Lake Josephine, Glacier Nat'l Park, *Maguire 473.* IDAHO: west end of Fernan L., Coeur d'Alene, *Rust 384.* WYOMING: Heart Lake Creek, Yellowstone region (mixed with v. *tenuifolius* in US; sheet in G not mixed); e. fork of Big Sandy, Wind River Mts., all 1878, *C. Richardson.* BRITISH COLUMBIA: Austey Creek, Shuswap L., *J. M. Macoun 4166.*

In 1930, Fernald showed that the American and eastern Asiatic plant which had been passing as *P. alpinus* Balbis of

Europe really differs from its European relative which has mostly broader submersed leaves with 9–15 nerves (as against 5–13 nerves in the American plant), a more compact inflorescence, and with the beak of the nutlet more or less straight so that the mature fruit is "narrowed and subequally attenuate to the prolonged submedian beak; those of the American and eastern Asiatic series broader, strongly rounded at the summit of the broad dorsal keel and laterally beaked at the summit of the ventral margin merely by a very short but often incurving style."[1] The submersed leaves of the wide-ranging American plant average narrower than those of typical *P. alpinus*, but broad-leaved plants occasionally occur and narrow-leaved ones are frequently found in Europe. Similarly, the degree of compactness of the spike is too variable to be more than a slightly supporting character. The differences in the shape of the fruit are, however, important. While foliage characters are rather variable among the broad-leaved species of *Potamogeton*, the characters of the fruit are more constant and any variation there is of primary importance. The fundamental difference between the fruits of the American and European plants lies in the rigidity of the beak of the endocarp. This beak is generally strong and rigid on the fruit of typical *P. alpinus* and remains rather straight at maturity. With the American plants, on the other hand, this beak is less rigid and often weak, especially at base, so that as the mesocarp matures and contracts, the beak is pulled toward the back and the drying mesocarp forms a false upwardly developed keel. This difference is a real and striking one and, were it consistent, enough to warrant maintaining the two entities as distinct species. But the American plants frequently have the rigid beak (see PLATE 746, FIG. 1), and spikes are occasionally found producing both types. An examination of a large series of the European *P. alpinus* shows that occasionally the beak is curved toward the back and the false upwardly-developed keel is produced. Hultén, who examined many sheets of the European material and who is familiar with the plant as it appears in Asia, says, "The form of the fruits and its beak are subject to considerable variation in the European material" and "the limit between the two types in Central Asia, where they meet, seems

[1] M. L. Fernald, RHODORA **32**: 80 (1930).

to be rather diffuse."[1] Because of this intergrading of characters, it seems best to regard the American plants as but varietally distinct from *P. alpinus* of Europe.

The only varietal name applied to the American *P. alpinus* is that of Gray who reduced it, along with a number of other distinct species, to *P. lucens* var.? *fluitans*. As this varietal name was based on *P. fluitans* Roth, it cannot be used here.

P. tenuifolius Raf. is based on the description of "*P. lucens*" in Michaux' Flora[2], and thus the specimen in the Michaux Herbarium at the Paris Museum, on which *P. lucens* sensu Michaux is founded, becomes the type. Two specimens are on this sheet. This has been ably discussed by Fernald[3], who chose the plant on the right to stand as the type of *P. tenuifolius* Raf. From a tracing it was surmised that the plant on the left represents *P. tenuifolius* var. *subellipticus* (*P. alpinus* var. *subellipticus*), but a photograph secured for the writer by Mr. Weatherby of the Gray Herbarium shows it to be *P. gramineus*. However, this in no way affects the typification of *P. tenuifolius* Raf., on which *P. alpinus* var. *tenuifolius* is based.

P. montanense of Gandoger is based upon a specimen which he cites as Rydberg 3724 from Shoshone L., Montana. The collection is Rydberg and Bessey 3724 from Shoshone L., Wyoming, with isotypes in several American herbaria. This collection was distributed as "*Potamogeton Zizii* Roth." Gandoger found it easy to distinguish from *P. Zizii*, so dubbed it a new species, choosing the name from the mistaken idea that it came from Montana. The isotypes seen by me are typical *P. alpinus* var. *tenuifolius*.

In North America, two varieties of *P. alpinus* are recognized which in their typical development are strongly marked and easily distinguished, but with many intergrades. The less common one (var. *subellipticus*) is generally found in shallow water and has a strong tendency to produce floating leaves. At first thought one might consider it to be merely an ecological state of the deep-water plant which is thus approaching the terrestrial condition. Such, however, seems not to be the case, for typical var. *tenuifolius* may be found in shallow water and

[1] Eric Hultén, Fl. Aleut. Is. 65 (1937).
[2] Andreas Michaux, Fl. Bor.-Am. **1**: 101 (1803).
[3] M. L. Fernald, Rhodora **33**: 210 (1931).

even stranded along the shore, while many specimens of var. *subellipticus* show evidences of having developed in deep water.

3. P. POLYGONIFOLIUS Pourret

RHIZOME buff or pinkish, often with cinnamon spots, about same thickness as stem. STEM simple, .7–2 mm. in diameter; stele with the proto-type pattern; endodermis mostly of O-cells; interlacunar bundles absent; subepidermal bundles present; pseudo-hypodermis 1 or 2 cells thick. SUBMERSED LEAVES (usually absent) with blades lanceolate, 3–10 cm. long, .5–1.5 cm. wide, tapering gradually at both ends, apex acutish but not sharp-pointed, petiole 1–3 cm. long; nerves 7–11, outer ones marginal; lacunae rather obscure, of 2–4 rows each side of mid-rib; margin entire. FLOATING LEAVES coriaceous, ovate, apex tapering to an obtuse tip, base rounded or slightly cordate, petioles 1–15 cm. long, blades 3–8 (–9) cm. long, 1–4 cm. wide, nerves (11–) 15–19 (–21), all of about equal prominence; lacunae none. STIPULES about 3 cm. long, somewhat persistent, without keels or practically so. PEDUNCLES about same thickness as stem, 4–12 cm. long. SPIKES with about 10 whorls, in fruit 2–3 cm. long, .5–.7 cm. wide. FLOWERS sessile or nearly so; sepaloid connectives greenish, blades orbicular or elliptical, 1–2 mm. wide, claws .3–.7 mm. long; anthers .6–.8 mm. long. FRUITS obovate to orbicular, rounded at base, sides with a depression, especially if immature, (1.6–) 2–2.5 mm. long, (1.2–) 1.5–2.1 mm. wide; beak minute or obsolete; keels absent or nearly so; exocarp reddish; endocarp loop often with a large cavity; apex of seed pointing toward the basal end or slightly above.

P. polygonifolius Pourr., Mém. Acad. Toulouse **3:** 325 (1788); Benn., Bot. Gaz. **32:** 58 (1901); Graebn. in Engler. Pflanzenr., **4:** fam. 11: 65 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 21 (1909); Hagstr., Crit. Res. Pot. 175 (1916).

Shallow pools and muddy brooks. Eastern Newfoundland, St. Pierre Island, and on Sable Island. MAP 4. Europe, northern Africa. NEWFOUNDLAND: George's Brook, near Clarenville, Aug. 1933, *Ayre;* Carbonear, Avalon Pen., *Fernald & Wiegand 4468;* Brigus Junction, Avalon Pen., *Fernald & Wiegand 4467;* Whitbourne, *Robinson & Schrenk 231;* near Portugal Cove, Avalon Pen., *Fernald, Long & Dunbar 26218;* Topsail, *C. S. Williamson 455.* ST. PIERRE ET MIQUELON: Savoyard, St. Pierre, *Arsène 41.* NOVA SCOTIA: Sable Island, 43° 59′ N., 59° 47′ W., *St. John 1121 & 1122.*

P. polygonifolius ranges through Europe, Algeria, Morocco, Madeira and the Azores[1], but appears in the western hemisphere

[1] The old world range of this species is taken from Hagström, Crit. Res. Pot. 178 (1916). It is also given a widespread Asiatic range by Bennett, Bot. Gaz. 32: 59 (1901).

only in eastern Newfoundland, the island of St. Pierre close by, and Sable Island off Nova Scotia. It may be presumed that this species in America, now confined to areas that largely escaped the last continental glaciation, once had a much wider range.

This species has a strong tendency to produce floating leaves which often spring almost directly from the rhizome. Terrestrial forms are common and in such condition may survive in ponds that dry up for a part of the summer.[1]

4. P. AMPLIFOLIUS Tuckerman

RHIZOMES whitish or often with a reddish cast, 2–4 mm. in diameter, scales black, broadly obtuse. STEM terete, 1–3.5 mm. in diameter, simple or forming short branches late in the season; stele with the proto-type pattern; endodermis of O-cells; interlacunar bundles present throughout; subepidermal bundles absent; pseudo-hypodermis 1 or 2 cells thick. SUBMERSED LEAVES (excluding transition leaves) of two more or less distinct types: those on the lower part of the stem lanceolate, dark green and usually badly decayed by the time the floating leaves appear, with 19–25 nerves: those of the upper part of the stem broadly lanceolate to ovate with margins much longer than midrib giving those leaves just below the floating ones a characteristic arcuate appearance, with 23–37 nerves; both types obtuse or acutish at apex, but never sharp-pointed, and tapering to petioles 1–6 cm. long; blades 8–20 cm. long, 2.5–7.5 cm. wide; margins entire; lacunae 3–6 rows each side of midrib. FLOATING LEAVES with gradual transitions from the submersed ones, coriaceous, opaque, ovate to elliptical, apex rounded or bluntly mucronate, base cuneate or rounded, petioles 8–20 cm. long, blades 5–10 cm. long, 2.5–5 cm. wide, with (21–) 29–41 (–51) nerves, about ¼ of the nerves more prominent than the others, as seen by transmitted light; lacunae none. STIPULES of the submersed leaves somewhat persistent, fibrous, triangular, obtuse when young, becoming twistedly stringy with age, 3.5–11 cm. long, obscurely 2-keeled; those of the floating leaves similar, 5–12 (–18.5) cm. long, with 2 fairly well marked keel-nerves and 30–40 fine nerves. PEDUNCLES at base about same thickness as stem, but usually thicker at the middle or upper half, 4–30 cm. long. SPIKES with 9–16 whorls; in fruit 4–8 cm. long, 1–1.5 cm. thick. FLOWERS sessile or on very short pedicels up to 1 mm. long; sepaloid connectives usually with a reddish cast, sometimes greenish, blades orbicular to elliptical, (1.2–) 1.5–3 (–3.5) mm. wide, claws .4–.8 (–1) mm. long; anthers .8–1.5 (–2) mm. long.

[1] See Harold St. John, Sable Island, etc., Proc. Bost. Soc. Nat. Hist. 36: no. 1: 59 (1921).

Fruits obovate, rounded on the back, cuneate at base, sides flat, 3.5–4.5 (–5) mm. long (excluding beak), 2.5–3.3 (–3.7) mm. wide, beak often prominent, up to 1 mm. long; keels usually prominent but sometimes rounded or obscure, the dorsal one often strongly developed, especially at the middle; exocarp usually reddish or orange-brown if fully mature, otherwise greenish; endocarp with 3 prominent, acutish and often somewhat muricate keels, beak linear, facial, about 1 mm. long, loop solid; apex of seed pointing .6–1.5 mm. above the basal end. Robust plants characterized by several large arcuate submersed leaves clustered just below the water surface, and floating leaves with numerous nerves.

P. amplifolius Tuckerm., Am. Journ. Sci. ser. 2: **6:** 225 (1848); Morong, Mem. Torr. Club. **3:** no. 2: 16 (1893); Graebner in Engler, Pflanzenr. **4:** fam. 11: 67 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 18 (1909); Hagstr., Crit. Res. Pot. 163 (1916). *P. lucens* var. ? *fluitans* (Roth) Gray, Man. ed. 2: 435 (1856), as to plants included in part, not *P. fluitans* Roth. *?P. amplifolius* forma *amphibius* Benn., Journ. Bot. **42:** 70 (1904). *?P. amplifolius* var. *ovalifolius* Morong ex Benn., Journ. Bot. **42:** 70 (1904); ? Graebn., in Engler, Pflanzenr. **4:** fam. 11: 68 (1907). *?P. amplifolius* var. *amphibius* (Benn.) Graebn. in Engler, Pflanzenr. **4:** fam. 11: 68 (1907). *Spirillus amplifolius* (Tuckerm.) Nieuwl., Am. Mid. Nat. **3:** 16 (1913). *P. amplifolius* forma *homophyllus* Hagstr., Crit. Res. Pot. 163 (1916).

Lakes and streams, usually in deep water. Newfoundland, south to Virginia and Tennessee, west to Missouri and Kansas, also in California, Oregon and Washington. Map 5. The following, selected from many specimens, are representative: Newfoundland: Salmonier R., 1931, *Ayre;* Frenchman's Cove, Bay of Islands, *Mackenzie & Griscom 10045.* Quebec: Lac Sainte-Anne, *Victorin, Rolland & Jacques 33517;* New Richmond, Bonaventure Co., *Victorin, Rolland & Jacques 33858;* Lake Memphremagog, July 29, 1902, *J. R. Churchill;* Rivière-aux-Serpents, Oka, *Victorin 20457, 21201 & 25815;* East Templeton, *John Macoun 85534;* East Templeton near Hull, *Malte 118267 & 118268.* McGregor L., *J. M. Macoun 86002;* Lac Lepêche, *Rolland 13044;* Otter L., Pontiac Co., *Gauthier 2422;* Lac Donaldson, Buckingham, *Rouleau 7231;* Kondiaronk (Lac Creux), *Victorin 16065.* Nova Scotia: Mill Brook, Sheffield's Mills, Kings Co., Aug. 24, 1902, *Fernald;* Young's L., North Mt., Belle Isle, Annapolis Co., *Fernald, Bartram, Long & Fassett 23139;* Lily L., Sandy Cove, Digby Co., *Fernald & Long 19688;* Little Meteghan L., Digby Co., *Fernald & Long 23140;* Sloane L., Pleasant Valley, Yarmouth Co., *Fernald,* et al. *19689.* Maine: Saint Francis R., Aroostook Co., Aug. 13, 1902, *Eggleston & Fernald;* St. John P., T. 6, R. 17, Somerset Co., *St. John &*

Nichols 2108; Eagle L., Piscataquis Co., *Ogden 1704;* E. Eddington, Penobscot Co., Aug. 21, 1897, *Fernald;* Harvey's P., Levant, Penobscot Co., *Ogden & Marston 1693, Plantae Exsiccatae Grayanae 904;* Loon L., Franklin Co., 1894, *Furbish;* Middle P., S. Poland, Androscoggin Co., Sept. 1893, *Furbish.* NEW HAMPSHIRE: Lime Pond, Columbia, Coös Co., *Pease 13883;* York P., Kilkenny, Coös Co., *Pease 17185;* Burns P., Whitefield, Coös Co., *Pease 14585,* also *Moore 5036;* Wolfboro, Carroll Co., *R. A. Ware 3326;* Squaw Cove, Squam L., Sandwich, Carroll Co., July 21, 1923, *Svenson;* Dublin, Cheshire Co., Aug. 8, 1931, *Eaton & Griscom;* Johnson Creek, Madbury, Strafford Co., *Hodgdon 2652.* VERMONT: Little Leech P., Averill, Essex Co., *Eggleston 1655;* Long Pond, Willoughby, Orleans Co., July 26, 1896, *Kennedy;* Willoughby L., Aug. 31, 1917, *E. J. Winslow;* Missisquoi Bay, Lake Champlain, Swanton, Franklin Co., Sept. 14, 1909, *A. E. Blewitt;* Spectacle L., Rutland Co., July 21, 1907, *E. C. Kent;* Big P., Rutland Co., Aug. 29, 1895, *E. C. Kent;* Chittenden, Aug. 18, 1895, *Eggleston.* MASSACHUSETTS: Wenham P., Wenham, Essex Co., July 13, 1895, *J. H. Sears;* Fresh P., Cambridge, Middlesex Co., many collectors; Concord R., Billerica, Middlesex Co., *Fernald & Abbe 2506;* Sudbury R., Concord, Middlesex Co., Aug. 4, 1886, *Morong,* also Aug. 4, 1886, *Deane,* also *Ogden & Wiggins 1729;* Wood's P., Wellesley, Norfolk Co., Aug. 1, 1881, *Morong;* Middleboro, Plymouth Co., Aug. 12, 1901, *J. Murdock;* Quinsigamond P., Worcester, June 29, 1864, *Robbins;* Great Brook, Southwick, Hampden Co., *Seymour 249;* Spectacle P., Sandisfield, Berkshire Co., June 27, 1912, *R. Hoffmann;* Egremont, *Standley & Killip 7648.* RHODE ISLAND: Pawtuxet R., Cranston, Providence Co., July 6, 1898, *J. F. Collins;* Apponaug P., "Kingston," [Apponaug Pond is in the town of Warwick] Washington Co., Aug. 26, 1880, *Morong.* CONNECTICUT: Thompson, Windham Co., June 10, 1922, *Eaton & Fassett;* East Granby, Hartford Co., *Weatherby D2409;* Hamlins P., Plainville, Hartford Co., *Blewitt 632;* Quinnipaug P., Guilford, New Haven Co., Sept. 1886, *W. R. Dudley;* Seldens Cove, Lyme, Aug. 29, 1901, *C. H. Bissell;* Mudge P., Sharon, *Weatherby & Anderson 5901;* Colebrook, Aug. 13, 1850, *J. W. Robbins;* West Goshen, Aug. 1892, *L. M. Underwood;* Twin Lakes Station, Salisbury, Litchfield Co., Aug. 20, 1935, *Fernald & Ogden.* NEW YORK: Mouth of Perch River, Jefferson Co., *Muenscher & Maguire 1600;* Spencer Lake, Spencer, Tioga Co., *Eames & Wiegand 11172;* Pierrepont P., Woodville, *House 8838,* also *Ogden & Bolan 1583;* Indian L., Franklin Co., *Muenscher & Maguire 719;* Eagle L., Essex Co., *Killip 12610;* Bemus Point, Lake Chautauqua, Aug. 8, 1896, *Churchill;* Edick Creek near Sears P., Lewis Co., *Hotchkiss 2646;* Rockland L., July 17, 1892, *Morong;* Carpenters P., Fabius, Onondaga Co., *House 1329;* Waldorf P., s. of North

Chatham, Columbia Co., *House 21752;* Pine P. (Gypsy L.), Putnam Co., *Muenscher & Curtis 5423;* Sodus Bay, *Killip 12261;* Lake Luzerne, Luzerne, Warren Co., *Fogg 4934;* Hudson R., Coveville, Saratoga Co., *Muenscher & Lindsey 2723;* North Harpersfield, Delaware Co., *Topping 203.* New Jersey: Delaware R., Camden, Oct. 7, 1877, *C. F. Parker;* Pensauken, Camden Co., *Adams & Trudell 378;* Swartswood L., Sussex Co., *Griscom & Mackenzie 10679;* Cranberry L., Sussex Co., *Mackenzie 2305;* Sparta, Sussex Co., Sept. 13, 1887, *N. L. Britton;* Hackensac R., Bergen Co., July 25, 1861, *C. F. Austin.* Pennsylvania: Martin's Creek, Northampton Co., Aug. 29, 1906, *C. S. Williamson;* Lehigh above Easton, June 15, 1869, *Thos. C. Porter;* near Peekskill, West Chester Co., 1868, *LeRoy;* Brandywine Creek, Icedale, Chester Co., Sept. 18, 1927, *H. E. Stone.* District of Columbia: near Washington, *Coville 129;* Eastern Branch below Navy Yard, Sept. 1, 1900, *E. S. Steele.* Maryland: Mouth of Mill Creek, Chesapeake Bay Region, *G. H. Shull 97.* West Virginia: Minnehaha Springs, Pocahontas Co., July 31, 1930, *W. V. U. Bot. Exped.;* also *E. E. Berkley 1387;* Huttonsville, Randolph Co., *Moore 2488.* Virginia: Four Mile Run, *Shull 413 & 473;* June 6, 1899, *E. S. Steele;* Dyke, Fairfax Co., *Metcalf & Sperry 1621, 1634, & 1639;* Hunting Creek, Dist. of Columbia and vicinity, *McAtee 2237 & 2279.* Georgia: Lafayette, Walker Co., *Wilson 189.* Ontario: Plevna, Aug. 19, 1902, *J. Fowler;* Epilobium Bay, Bear Island, *Watson 1178;* Whitney L., 12 mi. n. of Temagami, *Kane 1030;* Bass Creek, Franks Bay, Lake Nipissing, *Chitty 319;* McGregor Bay, Manitoulin District, *Ogden & Bolan 1647;* Gore Bay, Manitoulin Island, *Pease & Ogden 25032;* Old Woman's R., Bruce Pen., *Krotkov 8629;* Gull L., Addington Co., July 15, 1870, *John Macoun;* Belleville, Hastings Co., July 1876, *John Macoun;* Lac Meach, Ottawa, *Rolland 8697.* Michigan: Isle Royale, *Cooper 93 & 215;* Lake Manganese, Copper Harbor, Keweenaw Co., *Hermann 8233;* Carp R., Porcupine Mts., Aug. 16, 1923, *H. T. Darlington;* Crystal Falls, Iron Co., *Metcalf 2242, 2250, 2254 & 2255;* Michigamme L., Iron Co., *Metcalf 2209 & 2210;* Whitefish L., Mackinac Co., *Metcalf 2321;* Chassell, Houghton Co., *Pease & Ogden 25167;* Black L., Cheboygan Co., Aug. 3, 1935, *Gleason;* Little Manistee R., Manistee, Aug. 8, 1882, *Morong;* Washtenaw Co., July 17, 1838, *Houghton;* Mill-pond, Alma, Aug. 11, 1893, *C. A. Davis;* Kalamazoo R., Allegan Co., *Wight 97 & 109;* Kimble L., Vicksburg, Kalamazoo Co., July 5 & 28, *F. W. Rapp;* Sister Lakes, Van Buren Co., *De Selm 24* (F, mixed with *P. natans*); Papaw L., Berrien Co., *Dodge 172;* Haslet, *Yuncker 361.* Ohio: Geauga L., Portage Co., *Webb 546;* Phalanx, Trumbull Co., *Webb 452;* Cowles Creek Marsh, Ashtabula Co., Aug. 15, 1894, *Goodrich 209;* East Harbor, Ottawa Co., Aug. 10, 1898, *E. L. Moseley;* Put-in-Bay, Aug.

1898, *A. J. Pieters.* INDIANA: Lake Maxinkuckee, *Scovell & Clark 1223*, also *Clark 5 & 10*, also *Scovell 26* (US, mixed with *P. natans*) *& 28*, also *Evermann 1223;* 4.3 mi. south of Hayden, Jennings Co., *Deam 48399;* Loon L., Whitley Co., *Deam 49399;* Lake Manitou, Rochester, Fulton Co., *Deam 56490;* Wolf L., Whiting, Lake Co., *Deam 56616;* Wolf L., Lake Co., Aug. 18, 1920, *D. C. Peattie;* Hamilton L., Hamilton, Steuben Co., *Deam 56683;* Pine L., 2 mi. n. w. of La Porte, La Porte Co., *Deam 52425.* KENTUCKY: a specimen without locality data except "C. W. Short, M.D., Lexington, Kentucky." (NY). TENNESSEE: Mill-Sharp Lane, Lost Creek, Union Co., Aug. 2, 1933, *J. K. Underwood.* ALABAMA: Larkin Fork of Paint Rock R., Jackson Co., June 25, 1932, *Harper.* WISCONSIN: Green Bay, June 29, 1890, *Schuette;* Madison, July 30, 1889, *Trelease;* Lake Mendota, Madison, Dane Co., July 26, 1905, *A. B. Stout;* Lake Mendota, Aug. 20, 1912, *R. H. Denniston;* Hill L., Minocqua, Oneida Co., *Fassett 5362;* Deer L., Polk Co., Aug. 1892, *F. H. Burglehaus;* Pell L., Bloomfield Twp., Walworth Co., *Hotchkiss & Koehler 4192;* Kakagon Slough, Odanah, Sanborn Twp., Ashland Co., *Hotchkiss & Koehler 4353;* Pewaukee L., Milwaukee Co., Aug. 1884, *H. E. Hasse;* near Lac Vieux Desert, *Cheney 1735.* ILLINOIS: Lake Villa, Lake Co., *Gleason & Shobe 176;* Wolf L., Chicago, *Chase 1710;* Chicago R., Cook Co., July 21, 1906, *F. C. Gates;* Englewood, June 15–July 22, 1880, *herb. C. E. Faxon*, also July 22, 1880, *E. J. Hill;* Dupage R., Warrenville, *Moffat 294.* MINNESOTA: De Soto L., Becker Co., *Grant & Oosting 3275;* Cedar L., Rice Co., Oct. 22, 1891, *E. Douglas;* Lake Koronis, Stearns Co., *Kubichek 115b* (US, mixed with *P. natans*) *& 120;* Centre City, *Sandberg 658;* Chisago L., *Metcalf 1140 & 1160;* Center City, *Sandberg 656;* Basswood L., Lake Co., *Metcalf 1511;* Tait L., Kandiyohi Co., *Metcalf 2024;* Leech L., Cass Co., *Shunk & Manning 553;* Mille Lacs L., Mille Lacs Co., *Keck & Stevens 332;* Dudley L., *Keck & Stilwill 377;* L. Minnetonka, *Keck & Stilwill 433;* St. Louis L., Stearns Co., *Linsdale & Keck 54;* Maple L., Wright Co., *Linsdale & Keck 115;* Lake Francis at Elysian, Le Lever Co., *Moyle 2261.* IOWA: Clear L., Cerro Gordo Co., July 11, 1896, *B. Shimek.* MISSOURI: Poplar Bluff, Aug. 14, 1892, *F. W. Dewart;* Nettleton, Caldwell Co., May 7, 1893, *H. Eggert* (M, mixed with *P. pulcher*); Ha-ha-tonka, Camden Co., *Metcalf 929;* Gravois Mills, Morgan Co., *Metcalf 888*, also *Steyermark 28071;* Brice, Laclede Co., *Geo. Moore 81;* Niangua R., near Bennett Spring State Park, Dallas Co., *Steyermark 13782;* Eleven Point R., about 5 mi. n. e. of Peace Valley, Howell Co., *Steyermark 14487;* Jack's Fork of Current R., 5 mi. s. e. of Arroll, Texas Co., *Steyermark 14624;* near Double Spring (Rainbow Spring), 4 mi. n. e. of Dormis and 4 mi. s. e. of Dora, Ozark Co., *Steyermark 15560.* ARKANSAS:

Paragould, Green Co., June 27, 1893, *H. Eggert;* Powers Creek, 12 mi. s. w. of Batesville, *Coville 189.* North Dakota: Antler Creek, Antler, *Bergman 2484.* South Dakota: Lake Hendricks, Brookings Co., *Griffiths & Schlosser 4;* Little Minn. R., Roberts Co., *Over 15425 & 17142;* Pickerel L., Day Co., *Over 14459 & 17141.* Nebraska: Lincoln, *Webber 4;* Greenwood, *T. A. Williams 344;* Antelope Creek, Cedar Co., *Clements 2979.* Kansas: Comanche Co., *A. S. Hitchcock 1000;* Ellis, July 1876, *S. Watson;* Decatur Co., *A. S. Hitchcock 1099;* Spring P., Cottonwood Springs, Chase Co., Aug. 1870, *E. Hall.* Oklahoma: Sapulpa, *Bush 1318;* Cache, Comanche Co., *Stevens 1364* (US, mixed with *P. nodosus*). Montana: Fish L., Glacier Nat'l Park, *Standley 18528.* Idaho: Priest L., *Piper 3684,* also *MacDougal 303;* Alturus L., *Evermann 493.* California: Red L. above Soda Springs of the San Joaquin, Aug. 16, 1899, *J. W. Congdon;* Satcher L. near Devils' Post Pile, Madera Co., *Ferris 8845;* Webber L., Sierra Co., Aug. 1894, *Dudley.* Oregon: Salem, *E. Hall 487, 488 & 488a;* Ten-mile L., near Lakeside, Coos Co., *Peck 9026;* Sauvies Island, *Thomas Howell 1498.* Washington: Olympic Mts. near the coast, Clallam Co., *A. D. E. Elmer 2798;* Pullman, *Henderson 2474;* 28 mi. south of Tacoma on the Mt. Rainier Rd., Pierce Co., *Abrams 9241;* Blakeley Island, San Juan Islands, *S. M. & E. B. Zeller 1238;* Lake Whatcom, Whatcom Co., *Muenscher 7633 & 7634;* Lake Leland, Jefferson Co., *Otis 1768.* British Columbia: Dick's L., Sooke, Vancouver Island, *John Macoun 4364;* Elk L. near Victoria, Vancouver Island, *John Macoun 88252.*

P. amplifolius is a robust plant of ponds and streams, usually preferring the deep, clear water. It grows vigorously in either acid or alkaline water. The submersed leaves persist in acid or neutral waters, but if lime is present, it precipitates on the leaves to such an extent that they are soon broken off. This precipitate forms on *P. amplifolius* even when such minute traces of lime are present that other species show no evidences of it.

Although for its typical development this species prefers the deeper water, whenever its rhizomes creep up onto the muddy banks, terrestrial forms are produced. These are always sterile.

The variety *ovalifolius* that Bennett credits to Morong is presumably a state of *P. amplifolius*, but the meager description sounds suspiciously like *P. pulcher.* In view of the fact that Bennett reports *P. amplifolius* from Arkansas and from Florida[1], where it is not found, and *P. pulcher* from Maine[2] where it does

[1] Arthur Bennett, Journ. Bot. **42**: 77 (1904).
[2] ————, Journ. Bot. **40**: 146 (1902).

not seem to be, it is possible that he had the identities of these plants reversed. His forma *amphibius* is based in part on remarks of Morong[1], which definitely refer to *P. pulcher*. Graebner evidently copied Bennett's names and descriptions without any inquiry as to upon what they were based.

(*To be continued*)

THE SEASHORE STATE PARK, A PART OF CAPE HENRY, VIRGINIA

Frank E. Egler

Only four statements are appropriate in reply to the Fernaldian philippic upon my *Check List of the Ferns and Flowering Plants of the Seashore State Park, Cape Henry, Virginia*, published by the New York State College of Forestry, February 1, 1942. Fernald's comments appeared in Rhodora **44** (526): 342–343, 1942, as part of a footnote.

1. The functions of a state park check list are distinctive in serving both the professional and the amateur botanist. Certain concessions for the latter, especially in species concept and nomenclature, are made at the discretion of the author and cannot meet the approval of all botanists.

2. Of the five "misidentifications" kindly brought to my attention by Fernald, two are in the Cyperaceae, as identified by an authority in that group, and one of the two is due to a difference in species concept. The Sabatia, my specimens of which were not seen by Professor Fernald, he indicates as "presumably" another species because of the site in which it was found. The Rumex has been rechecked, but I am not yet willing to change the identification. The misidentification of the Yucca was my error. The author would appreciate receiving any other comments on these or the remaining 331 cited species of the Seashore State Park.

3. Criticism of the check list as being incomplete, and failing to include or to cite the numerous collections of other investigators from the more inclusive Cape Henry, is strikingly inappropriate. The Seashore State Park is only a small part of Cape

[1] Thomas Morong, Mem. Torr. Club. **3**: no. 2: 17 (1893).

Henry. Cape Henry collections would have been cited had they been definitely referable to land now within the park.

4. That I did not cite any of the collections in the Gray Herbarium is partly because of Fernald's own suggestion. On my visit to that herbarium specifically for the purpose of studying these plants I found it impossible to determine the exact localities from the label information on the sheets observed. In bringing this to the attention of Fernald, he indicated that he had not been aware of park boundaries while in the field, and could no longer locate his stations with sufficient preciseness for my purpose.

New York State College of Forestry
Syracuse, New York

[Kearney's map and lucid discussion show that he knew the location of Cape Henry, The Desert and the northeast side of Broad Bay. His many records from those areas are clearly from within the area shown on Egler's map of the Park. Had the author of the Check List cared to spend the several days necessary to hunt out the specimens in the Gray Herbarium, by means of a record of the identifications made available to him, those from within his area (all clearly labeled as from Cape Henry, The Desert, etc. and with habitats noted) could readily have been found and their identifications and exact localities noted. Had he taken the trouble to look up any of them he would have found the data sufficient. That was his responsibility.—M. L. F.]

Development of a Leafy Axis upon the Cones of a Tamarack.—A tamarack, *Larix laricina*, bearing a leafy axis upon many of its otherwise usually normal cones was noticed by the writer in the arboretum of the Wisconsin Experimental Game and Fur Farm at Poynette, Columbia County, Wisconsin. The shoots are variable in length, about 1 to 7 cm., and are not brachyblasts. At the time of collecting, in November, 1942, some of the shorter of these shoots had died, but many, including all observed long ones, were still alive. All grew leaves, and all bear axillary and terminal buds.

The tree, about seven feet in height, grows upon a dry, open slope, to which place it was transplanted four or five years ago. A nearby black or bog spruce, *Picea mariana*, has developed leaves over twice the length of those grown in the original condition. Whether or not the tamarack is also exhibiting an inherent ability to respond to an unusual habitat is unknown. Specimens from this tamarack are deposited in Gray Herbarium at Harvard University and in the Herbarium of the University of Wisconsin at Madison.

Such a condition of the American tamarack may never have been recorded. Mr. C. A. Weatherby of Gray Herbarium has written me that Penzig, in *Pflanzenteratologie*, ed. 2, iii. 497, states that this abnormality has been frequently observed on the European larch, but that Penzig gives no instance of its having been found on the American species.—George B. Rossbach, Poynette, Wisconsin.

A NOTE ON "FOSSIL EVIDENCE OF WIDER POST-PLEISTOCENE RANGE FOR BUTTERNUT AND HICKORY IN WISCONSIN"[1]

Stanley A. Cain

The thesis of this paper by Wilson and Webster[2] is that *Juglans cinerea* occurred in post-Pleistocene time about 50 miles east and *Carya cordiformis* about 90 miles north of their present limits in Wisconsin. The data presented to support this contention are as follows: *Juglans cinerea* was reported found in the peat of the 1.0, 1.5, 2.0, 3.5, and 4.0 foot levels, and was absent at the surface, 0.5, 2.5, 3.0, and 4.5 to 6.5 foot levels (the bottom); *Carya cordiformis* was reported found at the 1.0 to 5.0 foot levels, and was absent at all other levels. In all cases the frequency percentage of these species was 0.5 per cent, except for *Carya* at the 1.5 foot level where it composed 1.5 per cent of all grains counted.

The authors counted 200 grains from the peat at each level, in the range where *Carya* and *Juglans* occurred, which means that their conclusion that these species once grew near the bog is based on finding one grain of each species under consideration, with the exception noted above where three grains were encountered. Being aware of the possibility of criticism, they comment, "The fossil grains of these species are abundant in the peat even though they occur as a relatively small part of the total fossil count." Obviously, one must still depend upon percentages for purposes of comparison.

The crux of the matter is whether this small representation of pollen of *Juglans* and *Carya* is from trees that grew in the vicinity

[1] Contributions from The Botanical Laboratory, The University of Tennessee, n. ser. No. 60.

[2] L. R. Wilson and R. M. Webster. Rhodora 44: 409–414.

of the sedimentary basin, or whether it was blown in from perhaps as great a distance as now exists between the bog and the limits of the species. The authors rule out wind dissemination on the basis that these species are not represented in the surface layer. In this connection one might ask whether the apparent absence of *Juglans* from the 2.5 and 3.0 foot levels means that the species then retreated westward as it is supposed to have done since the time of the 1.0 foot level. They further reason that these species are probably under-represented in the peat because other deciduous species (*Acer*, *Tilia*, *Fraxinus*) growing in the vicinity today are not represented in the surface layer, whereas conifers are generally over-represented. Such relations do generally seem to prevail (especially the under-representation of insect pollinated species), but they do not constitute conclusive evidence that *Carya* and *Juglans* once grew near the bog.

In a recent study from our laboratory[1] of modern pollen rain in a spruce-fir forest in the Great Smoky Mountains, Gladys Carroll found *Picea* to be 15 per cent under-represented, and *Abies* 5 per cent and *Betula* 10 per cent over-represented, when compared with basal area percentages. Furthermore, pollen grains of several types were abundantly present although they had to be blown in from other climaxes than the spruce-fir. Their average percentages (over-representation) were: *Quercus* (9.4), *Pinus* (7.2), *Carya* (4.2), *Tsuga* (1.4), *Tilia* (trace), and *Liquidambar* (trace).

Henry P. Hansen[2] found pollen of fir species (*Abies nobilis*, *amabilis*, and *lasiocarpa*) in the peat of bogs on Orcas Island to the extent of a maximum of 16 per cent. Also, *Tsuga mertensiana* was sporadically represented. None of these is known from Orcas Island today, and Hansen says that although the species once may have grown on the Island their pollen grains also may have been blown from Vancouver Island or the Olympic Peninsula. This seems to me to be a reasonable stand, for the data are not conclusive, pro or contra.

Godwin[3] cites instances of pollen grains being wind blown 30

[1] In a paper submitted to the Amer. Jour. Bot.

[2] "A pollen study of two bogs on Orcas Island, of the San Juan Islands, Washington," in press in Bull. Torrey Bot. Club.

[3] "Pollen analysis. An outline of the problems and potentialities of the method." New Phytol. **33**: 278–305.

to 300 kilometers, and Malmström[1] presents evidence for wind transport up to 1000 kilometers. Dyakowska[2] calculates average limits of dispersal of pollen in kilometers for the following genera: *Fagus* (28), *Quercus* (65), *Ulmus* (77), *Alnus* (132), and *Salix* (218).

Although the data on distance of dissemination are inadequate, very few authors would venture to consider small percentages of pollen to be significant with respect to past areal limits of a species unless regional surveys also indicate the boundary or a conspicuous composition trend exists through the profile.

This criticism of the paper by Wilson and Webster is offered because of the realization that the science of pollen analysis can add valuable information to the history of forest composition and areas providing, however, that the peculiar sources of error of the method are adequately considered and only justified claims are made.

The University of Tennessee
Knoxville, Tenn.

THE PERENNIAL HELENIUM OF THE EDWARDS PLATEAU OF TEXAS

V. L. Cory[3]

With one exception, so far as known to us, the Heleniums growing on the Edwards Plateau are annuals and bloom in the spring. On August 18, 1937, a tall-growing, perennial Helenium blooming in midsummer and later, was collected at the edge of running water in Turtle Creek in Kerr County, Texas. The friend with me was familiar with *H. autumnale* L. as it grows in Mississippi, and he asserted that it was not that species. However, a leading botanist to whom material was sent so determined the plant. In using the key for Helenium in North American Flora, Vol. 34, Part 2, while checking this determination it was noted that our plant might just as well have been referred to *H.*

[1] "Degerö Stormyr. Untersuchungen eines nordschwedischen Moorkomplexes." Mitt. Forst. Versuchs. Schwedens 20.

[2] "Researches on the rapidity of the falling down of pollen of some trees." Acad. Polonaise Sci. Internatl. Bul. Ser. B (I): 155–168.

[3] Acting Chief, Division of Botany, Texas Agr. Expt. Station, A. & M. College of Texas, Sonora.

montanum Nutt. Seemingly it would more nearly have fitted into *H. latifolium* Mill. than in either of the other two species. Our plant is intermediate in point of pappus between on the one hand both *H. autumnale* and *H. latifolium* and on the other hand *H. montanum*, and, without making allowances it would not exactly fit into any one of these species. From an examination of this material at the Herbarium of the University of Texas it seems probable that *H. autumnale* does not extend into Texas from either north or east, but that the other species do extend into Texas. *H. montanum* comes down into Texas on the High Plains and *H. latifolium* does likewise on the Blackland Prairies. We have seen this Helenium growing only along Turtle Creek, but Dr. Tharp has collected it along Bull Creek in Travis County on September 12, 1920, and in swamps in Gonzales County on August 15 and on October 18, both in the year of 1940. Thus it is seen not to be of common occurrence. From the Kerr County locality it is just in excess of a hundred miles in a northeasterly direction to the Travis County location and much the same distance in a southeasterly direction to the Gonzales County location, which is below the Edwards Plateau.

Helenium **edwardsianum** n. sp. Plant a tall perennial, 1–2 m. high, branched above, densely short-pubescent; leaves lanceolate or oblanceolate, acute, tapering to the base, 7–12 cm. long, 1–2 cm. broad or more, shallowly glandular-denticulate, densely short-pubescent on both surfaces; heads radiate, corymbose; peduncles 3–6 cm. long; involucral bracts about 15, 7 mm. long, linear-lanceolate, densely short-pubescent; ray-flowers yellow, 1 cm. long or more, up to 8 mm. broad; disk globose, mostly 1 cm. in diameter or more; disk-corollas 2.5–3 mm. long, glandular-granuliferous; achenes 1 mm. long or more, hispid on the ribs; squamellae lanceolate, acuminate, 1 mm. long or more.

Helenium **edwardsianum** sp. nov. Planta perennis, 1–2 m. alta, sursum ramosa, conferte brevi-pubescens; foliis lanceolatis vel oblanceolatis, acutis, basi cuneatis, 7–12 cm. longis, 1–2 cm. latis vel ultra, haud profunde glanduloso-denticulatis, utrinque conferte brevi-pubescentibus; capitulis radiatis, corymbosis; pedunculis 3–6 cm. longis; bracteis involucralibus ca. 15, 7 mm. longis, lineari-lanceolatis, conferte brevi-pubescentibus; floribus radialibus luteis, 1 cm. longis vel ultra, ad 8 mm. latis; disco globoso, vulgo 1 cm. diametro vel latiore; disci corollis 2.5–3 mm. longis, glanduloso-granulatis; acheniis 1 mm. longis vel longioribus, costis hispidis; squamulis lanceolatis, acuminatis, 1 mm. longis vel longioribus.

Our plant is closely related to the three species, *autumnale*, *latifolium*, and *montanum*. *Edwardsianum* grows taller than do the other species; its leaves are not narrowly linear-lanceolate as Rydberg characterizes the leaves of *autumnale;* its squamellae are longer than is characteristic for *autumnale* and *latifolium* (both .7 mm. long) and are shorter than is characteristic for *montanum* (1.5 mm. long); its disk-corollas are relatively shorter, frequently no more than 2.5 mm. long as contrasted to the 3 mm. long in the other species; and its achenes are shorter than the 1.5 mm. in length given for these other species. As an intermediate plant between *autumnale* and *montanum* there possibly is indicated a closer relationship between these two species than has been acknowledged but, until such a relationship has been worked out, our plant may well be recognized as a distinct species.

The type specimen is designated as No. 24008, collected August 18, 1937, at the edge of running water on the banks of Turtle Creek, in Kerr County, Texas. It is deposited at the Gray Herbarium.

I wish to express grateful acknowledgment to Dr. Leon Croizat for valuable assistance given me in the preparation of the Latin description in this manuscript.

TWO LATER HOMONYMS.—POTENTILLA HYPARCTICA Malte, var. **elatior** (Abromeit), comb. nov. *P. emarginata* Pursh, Fl. Am. Sept. 253 (1814); Malte in RHODORA, XXXVI. 177 (1934); Polunin, Bot. Can. E. Arct. i. 275 (1940); not Desf. Tabl. Écol. Bot. 177 (1804). *P. emarginata*, c *elatior* Abromeit, Bot. Ergebn. B, 8 (1897).

Potentilla emarginata was based by Desfontaines upon *Fragaria sterilis* L. Although by the International Rules the name *P. emarginata* Desf. is illegitimate because Desfontaines did not take up the earlier specific name used by Linnaeus, it nevertheless invalidates the later *P. emarginata* Pursh. Malte in RHODORA, XXXVI. 173–178 (1934) discussed *P. emarginata* Pursh and its immediate allies. He then correctly treated as *P. emarginata* the southern plant of the group, which was described by Pursh from Labrador, collected by Kohlmeister, a plant which extends northward into the southern areas of the Arctic and southward

to the Shickshock Mts. of Gaspé. The extreme arctic plant was published as *P. hyparctica* Malte, l. c. 177 (1934). In treating the two as species Malte differed from Abromeit, Bot. Ergebn. B, 8 (1897) and Wolf, Mon. Pot. 533 (1908), both these close students of the group considering them to be geographic varieties of one species. Polunin, too, in his masterly Botany of the Canadian Eastern Arctic, i. 274–277 (1940), finds too many transitions between the northern and the southern series and, I think rightly, follows Abromeit and Wolf in treating them as varieties, Wolf having said of *P. emarginata*, var. *elatior* "Transit formis intermediis in varietatem praecedentem". Since the name *P. emarginata* Pursh is a later homonym, we must take up the first available specific name, which seems to be Malte's *P. hyparctica* (the high-Arctic plant), while the more southern *P. emarginata* Pursh becomes the variety.

Euphrasia Randii Robinson, var. **Reeksii,** nom. nov. *E. purpurea* Reeks, List of Fl. Pl. and Ferns of Newfoundland, 4 (1873); Fernald & Wiegand in Rhodora, xvii. 186 (1915).

Var. Reeksii, forma **candida** (Fern. & Wieg.) comb. nov. *E. purpurea*, forma *candida* Fern. & Wieg., l. c. 187 (1915).

E. Randii, forma **albiflora** (Fern. & Wieg.), comb. nov. *E. purpurea*, var. *Randii*, forma *albiflora* Fern. & Wieg., l. c. 188 (1915).

E. Randii, var. Farlowii Robinson, forma **iodantha** (Fern. & Wieg.), comb. nov. *E. purpurea*, var. *Farlowii* (Robinson) Fern. & Wieg., forma *iodantha* Fern. & Wieg., l. c. 189 (1915).

The dropping of the name *Euphrasia purpurea* Reeks (1873), taken up by Wiegand and me in 1915, is necessitated by *E. purpurea* Desfontaines, Fl. Atlant. ii. 36 (1798). In 1915 Wiegand and I leaned too trustingly upon Wettstein's Monographie der Gattung Euphrasia. The name *E. purpurea* not being there taken up nor indexed, we overlooked Desfontaine's species.—M. L. Fernald.

Volume 45, no. 530, including pages 26–56, was issued 13 February, 1943.

APR 14 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. April, 1943. No. 532.

CONTENTS:

Notes on Oklahoma Plants. *Milton Hopkins and U. T. Waterfall* 113

Fruit of Dirca palustris. *M. L. Fernald* 117

The Broad-leaved Species of Potamogeton of North America north of Mexico (continued). *E. C. Ogden* 119

The Senecio on the Coastal Dunes of Texas. *V. L. Cory* 164

Carex flexuosa in Minnesota. *Paul C. Lemon* 167

Scirpus Peckii in Canada. *M. L. Fernald* 168

The New England Botanical Club, Inc.

8 and 10 West King St., Lancaster, Pa.

Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

H

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. **April, 1943.** **No. 532.**

NOTES ON OKLAHOMA PLANTS[1]

MILTON HOPKINS AND U. T. WATERFALL

IN checking over some recent collections of Oklahoma plants we find the following species either new to Oklahoma or, for various reasons, of special interest.

The collections have been made for the most part by the junior author; the determinations have been verified by the senior author and have, in most cases, been checked by him at the Gray Herbarium.[2]

TYPHA TRUXILLENSIS H. B. K. OKLAHOMA COUNTY: in ditch, southeast corner of packing plant, Southwest 15th and Agnew Streets, Oklahoma City, *U. T. Waterfall,* no. 3060.

This very unusual plant common to temperate and tropical South America, Central America, and the West Indies, north to southern California, Texas and Louisiana, very likely replaces *T. angustifolia* in the southwestern United States. Professor Fernald first called attention to its occurrence in Virginia[3] and, puzzled by the tall forms of *Typha* which the junior author brought into the laboratory for determination, we studied all the specimens in the Bebb Herbarium, with the idea that this plant might prove to be that species. A duplicate specimen was sent to Professor Fernald and he verified our own tentative determination immediately. This represents an extension of range north from Texas. The senior author has since found it in the Arbuckle

[1] Contribution from the laboratory of the Dept. Plant Sciences, Univ. Okla., no. 78.

[2] The senior author is grateful to the Society of Sigma Xi whose Committee on Research Grants was kind enough to give him a grant-in-aid from its Alumni Fund for work at the Gray Herbarium during the summer of 1942.

[3] RHODORA **37**: 385–387. 1935.

Mountains and, although no other specimens in the Bebb Herbarium appear to be this species (of *T. angustifolia* there are only six or eight sheets in all), intensive search next spring will be undertaken in order to establish more stations for the plant if they can be found.

T. truxillensis differs from *T. angustifolia* in being much taller, the Oklahoma plants being between eight and nine feet high, and in having whitish-brown spikes and narrow, flat leaves. The leaves of *T. angustifolia* are plano-convex and its spikes are reddish-brown.

Aletris lutea Small. McCurtain County: sandy soil, in water oak-sweet gum association near Cypress Swamp, 7 miles southeast Broken Bow, *Waterfall*, no. 2118.

This specimen matches perfectly all the material in the Gray Herbarium but none has been seen from west of Louisiana. The only other species listed for Oklahoma is *A. aurea* and this plant is definitely not that, nor is it *A. farinosa* which reaches eastern Texas. Therefore, this collection constitutes a new record for Oklahoma and, as the station is in Oklahoma's narrow south-eastern strip of Coastal Plain, it constitutes a logical extension of range to the north and west. The more we botanize in this interesting area of Cypress Swamp and pine barrens the larger number of Coastal Plain plants we find there.

Arabis canadensis in Oklahoma.

During one of the numerous collecting trips to the Arbuckle Mountains, our party decided to cool off after a warm morning's work. We did so in a small dammed-up pond in the Viola Limestone formation, which we jestingly named Lacus Botanicorum. The senior author had just taken his first plunge in the crystal-clear water when the junior author spied a specimen of *Arabis* in the shade of a nearby rocky limestone ledge. When the senior author heard the good news he immediately forgot his swim and hastened to the ledge, identifying the specimen as *A. canadensis*. Though the species has been found in eastern Oklahoma it has not been seen so far west.[1]

[1] Rhodora **39**: 178. 1937. The specimen cited is from "Le Flore County, *T. R. Stevens* June 25, 1931 [U. S.]." This citation should read *T. R. Stemen*. The typewritten label in the U. S. National Herbarium misspelled the name of the collector, and the author at the time he was writing this treatment of *Arabis*, did not know that *T. R. Stevens* should be *Stemen*, the senior author of "Oklahoma Flora" (Harlow Publishing Co., Oklahoma City, 1937).

In the spring of 1942 several plants were found in the Reagan Sandstone formation of the Arbuckles as well as in the Frank's Conglomerate. Apparently, *Arabis canadensis* is no longer a rarity in this region.

MEDICAGO MINIMA L. OKLAHOMA COUNTY: state fairgrounds in Oklahoma City, *Waterfall*, 1939–41.

Although the literature does not include this species in the Oklahoma flora, it probably was introduced with feed in the livestock exhibits at the state fairgrounds.

PHRYMA LEPTOSTACHYA L. CUSTER COUNTY: in rich woods (*Ulmus-Gymnocladus-Celtis-Juniperus*) along creek, ¼ mile south, 1½ miles east of Weatherford, *Waterfall*, no. 2969.

The occurrence of this plant in the Wichita Mountains was reported in a previous paper.[1] This report was based on one specimen in the Bebb Herbarium, "on Little Wichita River, Comanche County, *A. H. Van Vleet*, July 2, 1903." Mr. Frank McMurry of the Wichita Mountains Wildlife Refuge, which is under the direction of the United States Department of the Interior, informs me that he has no record of the plant from the Wildlife Refuge, although he has botanized there more extensively than any other collector. A thorough search on all of the available maps does not indicate the existence of any stream called "Little Wichita River" and McMurry thinks that it may be a small creek of inconsequential importance, possibly a tributary of Cache (or, as it has frequently been spelled in the literature, "Cash") Creek. The junior author's present collection in Custer County is about 50 miles northwest of the mountains but by no means in the mountains themselves, and represents a northwestern extension of range for the plant in Oklahoma. The late Dr. Van Vleet (first head of the Dept. of Botany at the University of Oklahoma), unfortunately, gave very sparse information on his labels and it is not always possible to place his plants in a more specific area than the county. Inasmuch as the Wichita Mountains occupy the largest part of Comanche County it seems reasonably safe to assume that the Van Vleet specimen was actually collected there.

The two specimens in the Bebb Herbarium are the typical form of this species, not the var. *confertifolia* Fernald.[2]

[1] RHODORA **40**: 431. 1938.
[2] RHODORA **37**: 442. 1935.

Baccharis texana (T. & G.) Gray. Custer County: 7 miles west of Clinton, *Waterfall*, no. 1629.

The junior author found a single clump of this xerophytic *Baccharis* on one of his numerous field trips in the western part of Oklahoma. He took great pains to leave a portion of this so that the station might be preserved, but on a later trip the following summer he failed to find any remaining parts of the plant.

This has previously not been recorded from Oklahoma but Cory lists it from both the Plains country and the Edwards Plateau in his *Catalogue of the Flora of Texas* (his Area No. 7).[1] Custer County is in southwestern Oklahoma very near the Texas Panhandle. Undoubtedly, it occurs spasmodically throughout that part of the state and has simply not been previously collected.

Franseria tomentosa A. Gray. Cimarron County: moist spot in prairie near a thick stand of *Lippia*, 20 miles east of Boise City, *Waterfall*, no. 3136.

This is the first collection in Oklahoma and therefore constitutes another new record. In Texas Cory lists it in the Plains country (Area No. 7 in his Catalogue).[2] Boise City is in the Oklahoma Panhandle and is merely a part of the same plains country.

Achillea lanulosa Nutt. forma rubicunda Farwell. Oklahoma County: roadside in clay soil, 2½ miles west and ½ mile north of Britton, *Waterfall*, no. 1970.

This pinkish-flowered form is found rather frequently with the typical but has not before been recorded from the state.

Solidago trinervata Greene. Cimarron County: in stony slopes of larval hills along U. S. Highway 64, 1½ miles west of Kenton, 1½ miles south of the Black Mesa near the New Mexico line, *Waterfall*, no. 3168.

This specimen, identified by Dr. S. F. Blake, represents a range extension eastward from New Mexico. The literature does not list it from Oklahoma and no specimens are extant insofar as we are able to ascertain. However, it occurs in southwestern Texas. Cimarron County is bound by Texas on the south, New Mexico on the west, and Colorado on the north. Therefore, its flora is

[1] Tex. Agri. Exp. Sta. Bull. no. 550: 102. 1937.
[2] Ibid.

largely that of the high plains and the existence of this species in our flora is not unusual. The Black Mesa country, consisting of large buttes of black larval rocks, has only been sparsely botanized and such interesting plants as *Pinus edulis*, *P. ponderosa* and *Juniperus monosperma* abound there. It is without question one of the most thrilling regions, botanically, in the whole state. Each of the authors has made one trip to the area, though on separate occasions, and the collections are still to be identified. Many new records for the flora are anticipated as our studies progress.

TRAGOPOGON MAJOR—A CORRECTION

The junior author reported this plant as *T. pratensis*[1], having referred his specimen to that species because of its yellow flowers. Since more material has come to our attention, a closer study has indicated that an error was made. The cited specimen has fistulose peduncles and long involucral bracts which *T. pratensis* does not have. Because of these characteristics and its yellow flowers it could not be either of the two species listed in the floras and manuals (*T. pratensis* and *T. porrifolius*). Mr. Weatherby of the Gray Herbarium very kindly identified the plant as *T. major*, "a species of central Europe recorded as an escape in various parts of the United States." Since the original collections in the state fairgrounds three years ago, several additional stations east of Oklahoma City have been found.

UNIVERSITY OF OKLAHOMA,
Norman, Oklahoma.

THE FRUIT OF DIRCA PALUSTRIS.—In a recent most interesting paper Dr. Rogers McVaugh[2] challenges the accounts in current manuals of the drupe of *Dirca palustris* as "ovoid, reddish" or "red, oval-oblong", etc., on the basis of his observation of a specimen cultivated at Kinderhook, New York, this specimen producing drupes "somewhat spindle-shaped, pale green . . . with a very slight yellowish (not reddish) tinge." He assembles an array of citations showing that most of the earlier authors did not know the fruit but that Humphrey Marshall (1785) had

[1] RHODORA **42**: 501, 1940.
[2] MCVAUGH, *The Fruit of the Eastern Leatherwood*, Castanea, vi. 83–86 (1941).

described it, presumably from southeastern Pennsylvania, as "somewhat yellowish when ripe", that Bigelow in 1818 described it as "oval, acute, red", that in 1824 Torrey said "yellowish when ripe" (the exact phrase of Marshall); while Wood (1845), Gray (1848) and Chapman all say "red" or "reddish". And although he finds in the herbaria at Washington that "In nearly all cases the dried fruits, and especially the younger ones, have a suggestion of reddish color. This color is thought to have come about as a result of the drying process and may well have been the basis for the early reports of 'red' or 'reddish' fruits for this species."

The latter proposition might seem to dispose of the matter; but rather vividly remembering the reddish or purplish drupes as known to me in Maine when a boy, I have looked up some authors who certainly knew or know *Dirca* as it occurs in the woods. McVaugh refers to the infrequent fruiting of the shrub. Nevertheless, a good proportion (36 sheets) of the material before me from Quebec, Ontario, New England, New York, Michigan, Wisconsin, Minnesota and northeastern Iowa has well-formed and fully grown or ripe fruit. Throughout this region, furthermore, botanists who knew or who know plants in the field pretty generally report the ripe fruit of *Dirca* as red. McVaugh's cultivated specimen is the only one in this northern area which I have found definitely recorded as yellowish, although Mr. Bayard Long has often urged me, in Virginia, to show him *red* fruits, since in his experience they drop, fully ripe, when green or merely tinged with yellow. Jacob Bigelow and John Torrey stand out among American botanists as accurately describing plants from field-knowledge of them. Not only in Florula Bostoniensis, quoted by McVaugh, but in his very detailed Medical Botany, Bigelow, who with his student, Dr. John Locke and others, conducted chemical and pharmaceutical studies of the plant, including experiments with "A medical student who took several of the berries [and] found that they produced nausea and giddiness" (Bigel. Med. Bot. ii. 158 (1818)), described it definitely as red. Bigelow knew it to be red; the experimenting student "saw red". Similarly, in his very detailed account in his Flora of the State of New York, ii. 163 (1843), Torrey, there not quoting from Marshall, said "Fruit . . . reddish when

ripe." Similarly Alphonso Wood, who lived where *Dirca* abounds, said (1845), as already quoted by McVaugh, "Drupe oval (reddish)", and L. C. Beck, Bot. ed. 2: 307 (1848) said "reddish when ripe". Going outside New England and New York we find Victorin, who has many times collected *Dirca* in fruit, saying "Fruit: un drupe rouge, ovoide oblong" (Fl. Laurent. 362); Clements, Rosendahl & Butters, describing the shrub of Minnesota in Minn. Trees and Shrubs, 209 (1912), said "drupe oval-oblong, red"; while, writing from Iowa, Pammel, Man. Poisonous Pl. 643 (1911), definitely said "drupe red, oval, oblong". It is not reasonable to believe, as one might perhaps infer from the article which induced this note, that all the field-botanists, Jacob Bigelow, John Torrey, Alphonso Wood, L. C. Beck, Asa Gray, Clements, Rosendahl, Butters, Pammel, Victorin, my student, Mr. Bernard Boivin, who, when asked the color of the fruit near Montreal, promptly responded "purplish", and myself have mistaken yellow for purple or red. It is obvious that, whereas northward the ripe fruit generally becomes reddish or purplish, southward it often or always lacks this color and may become yellowish.

Furthermore, although McVaugh describes and illustrates the mature fruit as "spindle-shaped", with prolonged base and tip, the ripe fruits in the Gray Herbarium and that of the New England Botanical Club vary from slenderly rhomboid, with tapering tips, to thick-ellipsoid, with rounded ends, or obovoid, with broadly rounded summit, or even subglobose, with summit and base strongly rounded. The shape of the fruit seems to have no special geographic localization; the color possibly may have geographic significance. Here is an opportunity for close observation by those situated to make the observations.—M. L. Fernald.

THE BROAD-LEAVED SPECIES OF POTAMOGETON OF NORTH AMERICA NORTH OF MEXICO

E. C. Ogden

(*Continued from page 105*)

5. P. pulcher Tuckerman

Rhizome buff, often with dark red spots, .5–1 mm. in diameter. Stem simple, terete, 1–2.5 mm. in diameter, usually con-

spicuously black-spotted; stele with the proto-type pattern; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudo-hypodermis 1 cell thick. Submersed Leaves (excluding transition leaves) of two more or less distinct types, those of the lower part of the stem semi-opaque, oblong with rounded apices; those of the upper part of the stem translucent, lanceolate to lance-linear, not arcuate, apex acutish but not sharp-pointed, both types tapering at base to short petioles (up to 1.5 cm. long) or sometimes practically sessile; blades 8–14 (–18) cm. long, 1–2.5 (–3.5) cm. wide, nerves (9–) 11–21, outer ones marginal; margins entire; lacunae 4–8 rows each side of midrib. Floating Leaves coriaceous, ovate to rotund; apex rounded or bluntly mucronate; base cordate or rounded; petioles 4–18 cm. long; blades 2–7 (–11) cm. long, 1.5–4 (–8.5) cm. wide, with (19–) 21–29 (–35) nerves, all of about equal prominence, as seen by transmitted light; lacunae none or very faint. Stipules of the submersed leaves decaying early, those of the floating leaves persistent, narrowly triangular, obtuse when young, becoming acutish with age, 2–5 cm. long, 2-keeled. Peduncles of rather even thickness throughout, 5–8 (–11) cm. long. Spikes with about 10 whorls, in fruit 2–3.5 cm. long, .8–1.1 cm. thick. Flowers sessile or nearly so; sepaloid connectives usually with a greenish cast, blades orbicular to elliptical, (1.2–) 1.5–2.5 (–3) mm. wide, claws, .4–.8 mm. long; anthers .8–1.4 mm. long. Fruits obliquely ovate, rounded or cuneate at base, sides flat or slightly concave, (2.7–) 3–3.5 (–4) mm. long, (2.3–) 2.6–3.2 (–3.4) mm. wide; beak often prominent, up to .8 mm. long; keels usually prominent, acutish, the dorsal one often strongly developed, and sometimes with a basal lobe projecting below the point of attachment; exocarp mostly light brown, sometimes olive-green; endocarp with 3 prominent, acutish and somewhat muricate keels, beak linear, facial, about 1 mm. long, loop solid; apex of seed pointing .5–1.2 mm. above the basal end. Plants characterized by a conspicuously spotted stem, with large cordate floating leaves and lanceolate submersed leaves which taper rather abruptly to the base.

P. pulcher Tuckerm., Am. Journ. Sci. ser. 1: **45:** 38 (1843); Morong, Mem. Torr. Club **3:** no. 2: 16 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 67 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 21 (1909); Hagstr., Crit. Res. Pot. 152 (1916). *P. natans* sensu Bigel., Fl. Bost. 41 (1814), according to Tuckerm., Am. Journ. Sci. ser. 1: **45:** 38 (1843). *P. lucens* var. ? *fluitans* (Roth) Gray, Man. ed. 2: 435 (1856), as to plants included in part, not *P. fluitans* Roth. *?P. amplifolius* forma *amphibius* Benn., Journ. Bot. **42:** 70 (1904). *?P. amplifolius* var. *ovalifolius* Morong ex Benn., Journ. Bot. **42:** 70 (1904); ?Graebn. in Engler, Pflanzenr. **4:** fam. 11: 68 (1907). *?P. amplifolius* var. *amphibius* (Benn.)

Graebn. in Engler, Pflanzenr. **4:** fam. 11: 68 (1907). *Spirillus pulcher* Nieuwl., Am. Mid. Nat. **3:** 16 (1913). *P. pulcher* forma *amphibius* Hagstr., Crit. Res. Pot. 153 (1916).

Shallow muddy pools, peaty pond-holes and sluggish streams chiefly of the Coastal Plain and Mississippi embayment, southern Nova Scotia, southern New Hampshire, south to Georgia, Texas, Oklahoma, Arkansas, Missouri and Minnesota. Map 6. The following, selected from many specimens, are referred here. Nova Scotia: Sears L., New Tusket, Digby Co., *Fernald & Long 23137;* Rhodeniser L., e. of Bridgewater, Lunenburg Co., *Fernald & Long 23138.* New Hampshire: Contoocook R., E. Jaffrey, *Rand & Robinson 1013.* Massachusetts: Foster's Pond, Andover, Essex Co., *Pease 2011;* Waushakum P., Ashland, Middlesex Co., June 1879, July 1, 1881, July 5, 1882 & Aug. 7, 1882, *Morong;* Spot P., Stoneham, July 4, 1852, *Robbins;* Whitman P., Weymouth, Norfolk Co., *Seymour 4151;* Sampson's P., Carver, Plymouth Co., *Fernald 750;* Uncatena, Elizabeth Islands, Dukes Co., *Fogg 2997;* L. Neeseponset, Dana, Worcester Co., *Goodale, Markert & Piper 96988;* Readville, Suffolk Co., June 16, 1878 & June 16, 1880, *C. E. Faxon,* also June 23, 1879, *Morong;* Natick, June 1, 1881 & Sept. 27, 1881, *Morong;* Nantucket, Nantucket Co., July 1887, *Morong.* Rhode Island: ponds between Pilot Hill and Southeast Point, Block Island, Newport Co., *Fernald, Hunnewell & Long 8443;* Apponaug P., Apponaug, Aug. 26, 1880, *Morong.* Connecticut: Fairfield, *E. H. Eames 8740 & 8746;* Killingworth, Middlesex Co., Aug. 19, 1915, *C. H. Bissell.* New York: River Head, Wading R., Long Island, May 25, 1878, *E. S. Miller;* Long Island, May 1890, *F. N. Tillinghast;* Valley Stream, Queens Co., Long Island, July 1886, *J. A. Bisky;* Arden, Staten Island, Oct. 9, 1886, *A. Hollick;* Rockland L., July 17, 1872, *Morong.* New Jersey: Molly Wheaton Run, e. of Greenwich, Cumberland Co., *Fogg 2077;* Elmer, Salem Co., *Redfield 7996;* Cape May Court House, *Killip 30845;* Atlantic City, July 5, 1868, *C. F. Parker.* Pennsylvania: Tullytown, Bucks Co., May 24, 1930, *W. M. Benner.* Delaware: Record's P., Laurel, Sussex Co., *Fogg 1840;* Glendaniel (Hudson) P., 2 mi. s. of Lincoln, Sussex Co., *Fogg 4504;* Indian R., Millsboro, Sussex Co., May 23, 1876, *A. Commons;* cedar swamp, New Castle Co., Sept. 20, 1867, *Commons;* Cherry Island Marsh, below Edgmoor, Wilmington, July 27, 1896, *Commons;* Canterbury, July 1874, *Wm. M. Canby.* Maryland: Marshyhope Creek, Federalsburg, Caroline Co., *Shreve 1622;* Blackwater R., Dorchester Co., *Shreve 1597;* Willards, Wicomico Co., Aug. 12, 1910, *J. J. Carter.* Virginia: 4 miles n. w. of Waverly, Sussex Co., *Fernald & Long 5977;* brook entering Nowney Creek, Back Bay, Princess Anne Co., *Fernald, Griscom & Long 4535;* near Cornland, Norfolk Co., *Fernald & Griscom 4295;* pond near Luray Caverns, Luray,

June 1, 1909, *E. B. Bartram;* near Elko, *Grimes 4196;* vicinity of Cape Henry, *Killip 6896;* Great Dismal Swamp, *Kearney 1626;* Washington Canal, Dismal Swamp, *Boettcher 9;* Dahlia, Greensville Co., *Fernald & Long 8538.* North Carolina: Cape Fear R., Wilmington, herb. *Hexamer & Maier 466;* Hendersonville, Henderson Co., *Biltmore Herb., 5980ª.* Georgia: near Huguenin, Sumter Co., *Harper 1402;* Brier Creek, Screven Co., *Harper 2088.* Florida: Miccosukee L., *Sperry 509.* Ohio: Baumgartner's L., Jackson Twp., Franklin Co., Aug. 16, 1929, *H. T. Flint.* Indiana: pond about 3½ mi. n. w. of Grayville, Sullivan Co., *Deam 25704;* Pine Station, Lake Co., June 1884, *E. J. Hill;* Pine, Lake Co., June 21, 1897, *A. M. Chase.* Kentucky: Lexington, 1836, *C. W. Short;* s. e. of Mammouth Cave, Edmonson Co., *Svenson 156.* Tennessee: Goose P., Pelham, Grundy Co., *Svenson 9108 & 10150.* Alabama: Montgomery, Oct. 16, 1888, *Chas. Mohr;* slough along main highway 5 mi. w. of Tuscaloosa, Tuscaloosa Co., *Svenson 9427.* Illinois: Mason Co., Aug. 1860 & Aug. 1861, *E. Hall;* Athens, Menard Co., 1861, *E. Hall.* Minnesota: Colby L., Taylors Falls, *Metcalf 1291.* Missouri: St. Louis, 1838, *N. Riehl,* also Aug. 1847, *Geo. Engelmann;* Montier, June 8, 1890, *Bush;* north of Flatwoods, Ripley Co., *Steyermark 14245;* Little Black River, Pleasant Grove, Ripley Co., *Mackenzie 359;* between Gladden & Timber, Dent Co., *Palmer & Steyermark 41417;* Hogan, Iron Co., July 15, 1898, *C. Russell;* Nettleton, Caldwell Co., May 7, 1893, *H. Eggert* (M, mixed with *P. amplifolius;* F, NY, US, not mixed). Arkansas: Nettleton, Craighead Co., May 7, 1893, *Eggert;* Greene Co., May 7, 1893, *Eggert;* Judsonia, June 13, 1877, *H. S. Reynolds.* Louisiana: Calcasieu R., St. Martinville, Oct. 7, 1893, *A. B. Langlois* (US). Oklahoma: Page, Leflore Co., *Blakley 1453,* also *E. J. Palmer 33310.* Texas: Lindale, April 23, 1901, *Reverchon* (M).

Tuckerman's original description of *P. pulcher* is brief but leaves little doubt as to what plant he referred to this species. He was certainly in error however, when he stated that it has "much larger seeds" than *P. praelongus.* He was quite familiar with the *P. praelongus* of Fresh Pond, Cambridge, where it grew abundantly and was collected there by Boott, Tuckerman, Robbins, Morong, and the Faxons. However, all of the Fresh Pond material of *P. praelongus* seen by me lacks mature fruits, and it may be that Tuckerman did not at that time realize how large the mature fruits of that species really are. His supplementary description[1] is absolutely conclusive as to the plant he was describing.

[1] Edward Tuckerman, Am. Journ. Sci. ser. 2: 6: 224 (1848).

The forma *amphibius* and var. *ovalifolius* which Bennett referred to *P. amplifolius* may possibly be *P. pulcher*. They have been discussed under *P. amplifolius*. Hagström's forma *amphibius* is the terrestrial state so common to *P. pulcher*.

6. P. NODOSUS Poiret

RHIZOME white, suffused or spotted with rusty red. STEM simple, terete, often pressing very flat, 1–1.5 (-2) mm. in diameter; stele with the trio-type pattern, with the phloem on the inner face of the trio-bundle appearing as one patch; endodermis of O-cells (rarely more thickened on the inner face and appearing as U-cells); interlacunar and subepidermal bundles absent; pseudo-hypodermis absent. SUBMERSED LEAVES thin, linear-lanceolate to broadly lance-elliptical, 9–20 cm. long, 1–3.5 cm. wide, tapering gradually at base into a petiole 2–13 cm. long, tapering gradually to an acutish (but not sharp pointed) apex; nerves 7–15; lacunae of 2–5 rows along the midrib; margin of young blades with fugacious translucent denticles. FLOATING LEAVES coriaceous, with long petioles; blades lenticular to elliptical, cuneate or somewhat rounded at base, apex acutish to rounded (sometimes with an obtuse mucro), (3–) 5–9 (–11) cm. long, (1.5–) 2–4 (–4.5) cm. wide; nerves (9–) 13–21; lacunae rarely present. STIPULES of submersed leaves brownish, often delicate and decaying early, linear, acute or obtuse, 3–6 (–9) cm. long; those of the floating leaves similar but usually broader at base and more or less 2-keeled. PEDUNCLES usually thicker than the stem, 1.5–2.3 mm. in diameter, 3–15 cm. long. Young SPIKES compact but becoming loose at anthesis, of 10–15 (–17) whorls of flowers; at maturity usually not densely fruited, 3–6 (–7) cm. long, .8–1 cm. thick. FLOWERS sessile; sepaloid connectives greenish or brownish, orbicular or elliptical, (1.4–) 1.6–2.2 (to 2.6 on basal flowers) wide; anthers 1–1.4 mm. long. FRUITS obovate, 3.5–4 (–4.3) mm. long, 2.5–3 mm. wide; keels prominent, the dorsal strongly developed, especially upward, the laterals often muricate; beak facial, short; exocarp of mature fruits brownish or reddish; endocarp with keels strongly developed, dorsal often .5 mm. wide, the laterals strongly muricate, beak linear, erect, up to 1 mm. long, loop solid; apex of seed pointing a little above the basal end.—A variable species characterized by floating leaves cuneate at base, narrowly lanceolate submersed leaves tapering gradually to each end, and reddish fruits with strongly developed, often muricate, keels.

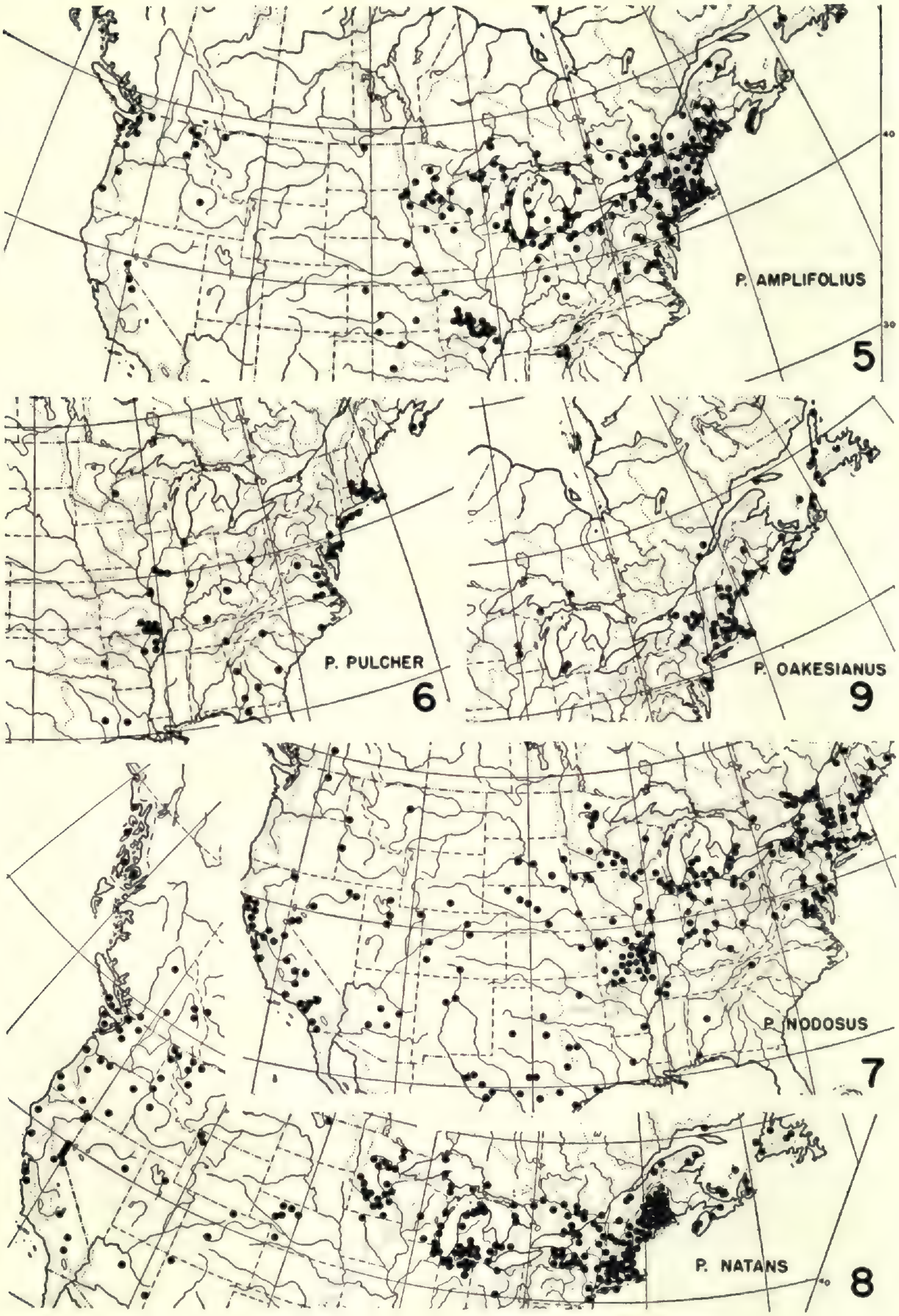
P. nodosus Poiret in Lamarck, Enc. Meth. Bot., Suppl. **4:** 535 (1816); Hagstr. Crit. Res. Pot. 183 (1916). *P. americanus* C. & S., Linnaea **2:** 226 (1827); Benn., Journ. Bot. **31:** 297 (1893); Taylor, N. Am. Fl. **17:** pt. 1: 19 (1909). *P. occidentalis* Sieber

ex C. & S., Linnaea **2:** 224 (1827); Taylor, N. Am. Fl. **17:** pt. 1: 20 (1909). *?P. montanus* Presl, Rel. Haenk. **2:** 85 (1835). *P. natans* var. *fluitans* sensu Torr. Fl. N. Y. **2:** 244 (1843). *P. lonchites* sensu Tuckerm., Am. Journ. Sci. ser. 2: **7:** 350 (1849), and subsequent Am. authors, not Tuckerm., ibid. ser. 2: **6:** 226 (1848). *P. lucens* var. ? *fluitans* (Roth) Gray, Man. ed. 2: 435 (1856), in part. *?P. plantagineus* var. *jamaicensis* Grisebach, Fl. Brit. W. Ind. 506 (1861). *?P. mexicanus* Benn., Journ. Bot. **25:** 289 (1887); ? Morong, Mem. Torr. Club **3:** no. 2: 22 (1893); ? Raunk., Bot. Tidskr. **25:** 266 (1903); ? Graebn. in Engler, Pflanzenr. **4:** fam. 11: 57 (1907); ? Taylor, N. Am. Fl. **17:** pt. 1: 18 (1909). *P. lonchites* var. *novaeboracensis* Morong, Mem. Torr. Club **3:** no. 2: 20 (1893). *P. americanus* var. *novaeboracensis* (Morong) Benn., Journ. Bot. **31:** 297 (1893). *P. pennsylvanicus* var. *portoricensis* Graebn. in Urban, Symb. Antill. **4:** 73 (1903), at least in part. *P. Nuttallii* var. *portoricensis* Graebn. in Engler, Pflanzenr. **4:** fam. 11: 56 (1907), at least in part. *P. fluitans* subsp. *americanus* (C. & S.) Graebn. in Engler, Pflanzenr. **4:** fam. 11: 60 (1907). *P. fluitans* subsp. *americanus* proles *novaeboracensis* (Morong) Graebn. in Engler, Pflanzenr. **4:** fam. 11: 62 (1907). *?P. coloratus* var. *jamaicensis* (Griseb.) Graebn. in Engler, Pflanzenr. **4:** fam. 11: 69 (1907). *?P. insulanus* Hagstr., Crit. Res. Pot. 154 (1916). *P. rotundatus* Hagstr., Crit. Res. Pot. 153 (1916). *P. fluitans* sensu Am. authors, ? not Roth, Tent. Fl. Germ. **1:** 72 (1788). *Spirillus lonchites* (Tuckerm.) Nieuwl., Am. Mid. Nat. **3:** 16 (1913).

A widespread species of ponds and streams, generally in flowing water, southern Quebec and New Brunswick to southern British Columbia, south to Virginia, Tennessee, Louisiana, and California. Map 7. Mexico and the West Indies, South America (rare), Eurasia, Africa. The following, selected from a large series, are representative: Quebec: St. Lawrence River, St. Jean-Port-Joli, L'Islet Co., *Svenson & Fassett 934;* Saint-Lambert de Lauzon, Levis Co., *Victorin, Rolland & Meilleur 43858;* Sainte-Rose, Laval Co., *Victorin & Rolland 43565 & 49304,* also *St. Cyr 3030;* Longueuil, Chambly Co., *Rolland 43359;* Angers, Ottawa R., *Rolland 19269;* Wakefield, *John Macoun 62015 & 62016;* Sainte-Sulpice, L'Assomption Co., *Ricard & Boivin 342.* New Brunswick: St. John R., Lincoln, Sunbury Co., *Fassett 2149.* Maine: Houlton, Aroostook Co., Aug. 26, 1897, *Fernald;* Pushaw Stream, Old Town, Penobscot Co., *Ogden, Steinmetz & Prince 1596,* also *Steinmetz 326.* Androscoggin R., Gilead, Oxford Co., Oct. 1, 1897, *Furbish;* Sydney, Kennebec Co., *Fernald & Long 12389;* St. George R. near Indian Garden, Warren, Knox Co., Aug. 15, 1913, *Norton.* New Hampshire: Connecticut R., vicinity of Hanover, Grafton Co., Aug. 17, 1876, *H. G. Jesup;* Cornish, Sept. 2, 1886, *F. H. Knowlton.* Vermont: Ferrisburg

and Vergennes, many collectors; Lake Champlain, Orwell, Addison Co., *Cushman 6007;* Hydeville, Rutland Co., July 21, 1892, *Eggleston;* Winooski R., Burlington, Aug. 25 & 27, 1885, *Morong*. MASSACHUSETTS: Concord, Aug. 12, 1887, *E. S. Hoar;* Mystic P., Oct. 1, 1865, herb. *Wm. Boott;* Winchester, Sept. 1, 1880, Aug. 8 and Aug. 29, 1881, *Morong* (the latter mixed with *P. nodosus* × *epihydrus* in Gray Herb.); Connecticut R., Springfield, Sept. 6, 1864, *Robbins;* Harmon P., Sheffield, Berkshire Co., Aug. 12, 1914, *R. Hoffmann;* Pauls Bridge, Neponset R., Readville, May 30, 1881, herb. *E. & C. E. Faxon;* Egremont, *Standley & Killip 7649*. CONNECTICUT: New Hartford, *Driggs 40;* Twin Lakes Station, Salisbury, Litchfield Co., Aug. 20, 1935, *Fernald & Ogden;* Lake Whitney, New Haven, Sept. 24, 1886, *W. A. Setchell;* Housatonic R., Stratford, 1845, *Robbins;* Housatonic R., Newtown, Fairfield Co., *A. E. Blewitt 3657*. NEW YORK: N. Beaver Creek, Haynes Hill, W. Fort Ann, Washington Co., Aug. 26, 1914, *Burnham;* Guildenland, Albany Co., *House 21774 & 22044;* Ellisburg, Jefferson Co., *House 19852 & 20002;* Ithaca, Tompkins Co., *R. Hitchcock 11167 & 11168;* Lake Erie, Buffalo, Aug. 20 & 25, 1886, *Morong;* Niagara Rapids, *E. Tuckerman* (*P. lonchites* of Tuckerman's supplementary description, but not of original description); pool near White Creek, DeKalb Co., *Phelps 1091;* Grass R., Canton, *Phelps 1665;* Raquette R., above Potsdam, St. Lawrence Co., *Muenscher & Clausen 3751 & 3752;* Float Bridge, Rochester, *Baxter 5389;* Chemung R., Chemung Co., *Lucy 424 & 10816*. NEW JERSEY: Oldmans Creek, 1.5 mi. n. n. e. of Eldridges Hill, Salem Co., *Fogg 6794*. PENNSYLVANIA: Harrisburg, Sept. 1893, *John K. Small;* Penn's Creek at the "Swinging Bridge," Selinsgrove, Snyder Co., *Moldenke 4208;* Sellersville, 1868, *C. D. Fretz;* vicinity of McCalls Ferry, York Co., *Rose & Painter 8205;* Chester Co., July 1858–1864, *S. P. Sharples 303*. DELAWARE: Shelpot Creek, Wilmington, June 17, 1879, *A. Commons;* Brandywine, Wilmington, Aug. 17, 1896, *A. Commons;* White Clay Creek, Stanton, Sept. 4, 1896, *A. Commons*. MARYLAND: Chicomuxen Creek, *Tidestrom 7637;* Mill Creek, Chesapeake Bay region, *Shull 95;* Cabin John, Montgomery Co., *Painter 1189*, also *Dowell & Painter 5385;* Chesapeake Canal above Cabin John, near Lock 13, *Leonard & Killip 603;* Spesutie Island, Harford Co., *Moldenke 9396;* Great Falls, *House 517*. DISTRICT OF COLUMBIA: Arlington Junction, Sept. 28, 1897, *E. S. Steele;* C. & O. Canal above Georgetown, Aug. 9, 1897, *T. H. Kearney;* Georgetown, *Van Eseltine & Moseley 202;* Fish Ponds, *Shull 39*. WEST VIRGINIA: Cacapon R., Hardy Co., Aug. 13, 1930, *W. V. U. Bot. Exped.;* Tygart R., Beverly, Randolph Co., *Millspaugh 457*. VIRGINIA: Four-Mile Run, Chesapeake Bay region, *Shull 474;* near Leedstown, *Tidestrom 7741;* Potomac R., The Dyke, *Tidestrom 7183;* Dyke,

Fairfax Co., *Metcalf & Sperry 1622 & 1630* Hunting Creek, *McAtee 2374*. Ontario: Rideau R., at Billings Bridge, Ottawa, *Malte 118274;* Mississippi R., Galetta, Carleton Co., *Ogden & Bolan 1629 & 1630;* Chatham, *Cain 935;* Nation R., Casselman, Aug. 21, 1884, *John Macoun*, also *Malte 118275;* Nation R., Russel, *Macoun 22177;* Maitland R., Goderich, *Macoun 26839;* Golden L., Renfrew Co., *Macoun 22177*, Dunnville, *John Macoun 26841;* near Lake Muskoka, Aug. 29, 1899, *D. LeRoy Topping;* L'Original, *Rouleau 304*. Michigan: Kalamazoo R., Allegan Co., *Wight 86, 87a, 87b, 87c, 88, 98 & 123;* Grand Rapids, July 21, 1895, *W. E. Mulliken;* Vandercooks L., Jackson Co., July 21, 1898, ex herb. *S. H. & D. R. Camp;* Pine L., Aug. 20, 1892, *C. F. Wheeler;* Gun R., Barry Co., July 1926, *Oosting;* Freemont L., Newaygo Co., July 9, 1926, *Oosting;* Black L., Ottawa Co., Aug. 27, 1926, *Oosting;* Huron R., 3½ mi. s. e. of Ann Arbor, Washtenaw Co., *Hermann 9383*. Ohio: Brady L., Portage Co., July 29, 1913, *R. J. Webb;* Put-in-Bay, Aug. 1898, *A. J. Pieters;* Presque Isle Point, Sandusky Bay, Aug. 19 & 29, 1895, *E. L. Moseley;* Buckeye Creek, Liberty Twp., Jackson Co., *Pontius & Bartley 18*. Indiana: Walnut Creek, 2 mi. n. e. of Bainbridge, Putnam Co., *E. J. Grimes 594;* Aberdeen, Ohio Co., *Deam 56783;* Lake Maxinkuckee, *Scovell 32;* Tippecanoe R., 6 mi. n. and 1 mi. e. of Winemac, Pulaski Co., *Welch 2106;* Calumet R., Clarke, *Lansing 1059;* n. of Spencer, Owen Co., *Deam 38978;* mouth of John's Creek, Wells Co., July 2, 1905, *Deam*. Kentucky: 3 mi. s. of Richmond, Madison Co., *Svenson 7216;* Kentucky R., June–July, *Dr. Short;* Ohio R., Louisville, Sept. 16, 1854, *C. Mohr*. Tennessee: n. fork of Holston R., near Kingsport, Hawkins Co., *Sharp & Underwood 33521;* Reelfoot L., Lake Co., *Demaree 7051 & 7132*. Alabama: Mobile R. near Piute Island, May 28 & July, 1884, *Chas. Mohr;* East L., near Birmingham, Jefferson Co., *Biltmore Herb. 5806b*. Wisconsin: between Duck Creek R. and Bars Channel, Green Bay, July 28, 1891, *Schuette;* Wisconsin R., near Newport, Delton, Sauk Co., Aug. 26, 1906, *A. B. Stout;* Pickerel Slough, Prairie du Chien, Crawford Co., *Fassett 4350;* Lake Mendota, Middleton, Dane Co., *Fassett 3148;* near Tomahawk, *Cheney 1086*. Illinois: Calumet L., Chicago, *Chase 1420;* Wolf L., Chicago, June 10, 1911, *Sherff;* Du Page R., Naperville, June 22, 1895, *L. M. Umbach;* Ogden Ditch, Summit, *Hill 159, 1909;* Lyons Twp., Cook Co., *Hill 151, 1901;* Fox R., Richland Co., *Ridgway 3318;* Lake Lawrence, Lawrence, *Ridgway & Eaton 3425;* Swan L., near Grafton, Calhoun Co., *Metcalf 1105;* Oquawka, 1879, *H. N. Patterson*. Minnesota: Wabana L., Itasca Co., *Metcalf 1471*, also *Kubichek 148 & 149;* Borden L., Garrison Twp., Crow Wing Co., *Hotchkiss & Jones 480 & 4109;* Ft. Snelling, June 1895, *E. P. Sheldon*, also *Mearns 805;* Minn. R. bottoms, Dakota



RANGES OF POTAMOGETON

Co., June 1895, *E. P. Sheldon;* Green L., Kandiyohi Co., *Metcalf 2046;* Mazaska L., Rice Co., *Keck & Stilwill 401;* Courtland, Nicollet Co.. July 1892, *C. A. Ballard.* Iowa: Fayette, July 1893, *B. Fink;* Estherville, Aug. 7, 1897, *R. I. Cratty;* Granite, Lyon Co., Aug. 4, 1896, *B. Shimek;* Des Moines R., July 1881, *R. I. Cratty.* Missouri: along Current R., near Doniphan, Ripley Co., *Steyermark 9233, 14257 & 14259;* Gasconade R., s. e. of Hazel Green, Pulaski Co., *Steyermark 25102 & 25103;* n. w. of Waynesville, Pulaski Co., *Steyermark 25249;* Gasconade R., n. e. of Vienna, Maries Co., *Steyermark 25603;* Buffalo Creek, s. e. of Louisiana, Pike Co., *Steyermark 25876;* Sect. 6, w. of Lynchburg, Laclede Co., *Steyermark 27148;* Osage R., Mary's Home, Miller Co., *Steyermark 13083 & 13097;* Iron Mountain L., *Metcalf 842;* Killarney L., East Arcadia, *Metcalf 845;* Ice P., Unionville, *Metcalf 1071;* Duck L., Platte Co., *Metcalf 1024;* Goose P., Springfield, *Standley 9780;* Gascondy. *Emig 224;* e. of Ashland, Boone Co., *Drouet 3028;* n. w. of Joplin, Jasper Co., *Palmer 21526;* Meramec, Sept. 2, 1886, *Eggert;* Meramec R., St. Louis Co., Sept. 12, 1886, *Eggert;* Atherton, Jackson Co., *Bush 630;* Sheffield, Jackson Co., Aug. 4, 1896, *Mackenzie;* White R., Forsythe, Taney Co., *Trelease 817.* Arkansas: Big L., Hornersville, *Metcalf 636;* Saline R., Ozment Bluff, Drew Co., *Demaree 17893.* South Dakota: Sioux R., near Brookings, Sept. 1, 1893, *T. A. Williams;* Medicine Creek, near Canning, Aug. 16, 1892, *T. A. Williams 1;* s. of St. Pierre, Stanley Co., *Over 17432.* Nebraska: Niobrara R., southwest of Valentine, *Tolstead 637;* Middle Loup R., near Norway, Thomas Co., *Rydberg 1421;* Anselmo, July 6, 1889, *Weber 6;* Lake Manawa, near Omaha, *Lawton 50.* Kansas: Topeka, Aug. 1870, *E. Hall.* Oklahoma: near Cache, Comanche Co., *Stevens 1364* (G, US, mixed with *P. amplifolius,* NY, not mixed); Sapulpa, *Bush 1207.* Texas: Comanche Spring, New Braunfels, *Lindheimer 1234;* Little Aguja Canyon, Jeff Davis Co., *Moore & Steyermark 3077;* Haley Ranch, Brewster, *Cory 9198;* Victoria, *Lindheimer 393;* Lake Polk, near Temple, Bell Co., *Wolff 3290;* Dallas, June 25, 1929, *Mary R. Stephenson;* Lubbock, *Reed 3168;* Nueces R., Uvalde, Uvalde Co., *Palmer 33707;* Houston, Harris Co., *Palmer 11952;* Sycamore Creek, Fort Worth, *Ruth 141.* Montana: Great Falls, *R. S. Williams 285.* Idaho: Payette, *Henderson 4882.* Wyoming: Ft. Steele, Carbon Co., *Goodding 539.* Colorado: Lee's L., *Crandall 2530;* Alamosa, *Clements 305;* Rio Grande, Alamosa, *Shear 3745;* Owen's L., Boulder, *Daniels 683;* Gunnison R., Grand Junction, Mesa Co., *Biltmore Herb. 5806*[a]. Utah: Hills Park, Salt Lake City, June 29, 1908, *Mrs. J. Clemens;* Hill Creek, Uinta Basin, Uinta Co., *Graham 9821;* near Goshen's fixed sand-dunes, Utah Co., *Garrett 3958;* Corinne, *Wetmore 395.* Nevada: Hot Creek, near Gold Creek, Elko Co., *P. B. Kennedy*

4476; Glendale, Truckee valley, Washoe Co., *P. B. Kennedy 3041;* Sparks, near Reno, *A. E. Hitchcock 444;* North Fork, *A. E. Hitchcock 1034;* Wadsworth, *Tidestrom 10655.* NEW MEXICO: Santa Fe, *Fendler 837;* San Jose, near Santa Fe, *Arsène & Benedict 16636;* Albuquerque, Oct. 13, 1894, *C. L. Herrick.* ARIZONA: Camp Verde, *W. W. Jones 432;* Lower Oak Creek, *Fulton 9703;* Granite Reef Dam, Maricopa Co., *Peebles 14190;* Pinal Creek, *Toumey 496;* Beaver Creek, *MacDougal 543.* CALIFORNIA: Pit R., at Lookout, Modoc Co., Aug. 24, 1899, *M. S. Baker;* Big R., Mendocino Co., *McMurphy 192;* Russian R., n. of Cloverdale, Mendocino Co., *Heller 5824;* Mormon Creek, Tuolumne Co., *Williamson 309;* Santa Cruz, *M. E. Jones 2310;* Visalia, Tulare Co., *Coville & Funston 1278;* Bakersfield, Kern Co., *Coville & Funston 1244;* Laguna Lakes, Orange Co., *Street & Williams, 2689;* Colton, San Bernardino Co., *Parish 2106 & 2128;* Deep Creek, San Bernardino Mts., San Bernardino Co., *L. C. Wheeler 1974.* WASHINGTON: Okanogan R., *Sereno Watson 398.* BRITISH COLUMBIA: Kamloops, June 26, 1889, *John Macoun 2970.*

P. fluitans of European authors consists of two quite independent plants: one a fruiting plant with an endodermis of O-cells and no bundles in the cortex; this occurs in North America. The other is a sterile plant with an endodermis of U-cells and with numerous bundles in the cortex; this plant is thought to be a hybrid, *P. lucens* × *P. natans.* Roth's original description,

> P. foliis inferioribus longissimis, lanceolatis, acuminatis, membranaceis; superioribus ouali-lanceolatis, coriaceis: omnibus petiolatis.
> Habitat in fossis profundis lente fluentibus et in *Hunte* fluuio *Ducatus Oldenburgensis,*

would include both plants. The fact that no fruits are described does not at all mean that Roth's plant lacked them, for at that time vegetative characters were given prominence and the fruits often ignored. Of the thirteen species of *Potamogeton* described in Roth's flora where *fluitans* is proposed as new, not one of them has any mention of fruit. Even if Roth's specimens lacked fruit, it does not follow that they were the non-fruiting entity with bundles in the cortex. Bennett thought the name *fluitans* ought to be kept for the hybrid, saying, "We have no certain knowledge of any specimen of Roth's species being preserved in any herbarium; but there are at Munich specimens in Schreber's herbarium, named as such and gathered 'In Seebach, 1775,' and others, 'In Seebach, 1782.' It seems to me a reason-

able inference that these specimens are from (or seen by) Roth; the more so because there are other species in the same collection actually received from Roth, and signed by him. They are the plant we call *fluitans* in England (hybrid?)"[1]. Later he adds, "The following extract from Roth's *Catalecta Botanica* (fasc. 1, p. 31, 1797) will show that Schreber's specimens in the Munich Herbarium are, as I supposed, the plant of Roth: . . . 'Prope *Erlangam* etiam observavit Ill. Praes. *de Schreber*'"[2]. To this Raunkiaer answers, "that because a herbarium contains plants actually from Roth it can not be necessary that other plants in the same herbarium should be from him. The specimens from the Munich herbarium mentioned have been examined by me and that they belong to the barren form of *P. fluitans* is true enough but they can not in the least be considered original specimens."[3] He then attempts to show that in the Bremen herbarium there is a specimen which has a good chance of being the original; and it is the plant with O-endodermis and lacking bundles in the cortex. He also states that in the "Petersburg herbarium and examined by me . . . three specimens . . . may well be original specimens."[4] As these specimens also proved to be the fertile plant he concludes that we should retain the name *P. fluitans* for the fertile species which lacks strengthening tissue in the cortex. Hagström agrees that "This proof would be very strong, if those specimens examined also really corresponded with the original description by Roth 'foliis inferioribus longissimis' . . . which they can scarcely be said to do."[5] From Roth's later and more detailed description[6] it does appear that he then was at least including the barren form with his *P. fluitans*. Also, it would seem, if Roth had in mind the specimens in the Bremen and Petersburg herbaria when drawing up his original description, that he would have mentioned them in his Catalecta Botanica, as he does mention the Schreber specimens. It thus appears that the evidence that *P. fluitans* should be retained for the fruiting plant is not strong, and I am

[1] Arthur Bennett, Journ. Bot. **31**: 296 (1893).
[2] ————, Journ. Bot. **39**: 198 (1901).
[3] C. Raunkiaer, Bot. Tidskr. **25**: 278 (1903).
[4] ————, Bot. Tidskr. **25**: 278 (1903).
[5] J. O. Hagström, Crit. Res. Pot. 184 (1916).
[6] A. G. Roth, Tent. Fl. Germ. **2**: 202 (1789).

inclined to agree with Hagström in treating it as a *nomen confusum*. Hagström takes up for this plant *P. nodosus* Poiret.

P. nodosus Poiret is based on a plant from the Canary Islands, collected by Broussonet. This specimen should be in the Paris Museum. A photograph of it was, some years ago, requested by the Gray Herbarium but not received. The original description agrees with the specimens here placed under that name, but is not conclusive. Until it can be shown that the Canary Island plant is not the wide-ranging species correlated with it, it is best to retain Poiret's name, as taken up by Hagström, for the American plant.

The species in North America is a rather variable one. The floating leaves especially vary greatly in size. Morong's var. *novaeboracensis* (of *P. lonchites*) covers the large-leaved form, which in America is less frequent than the narrow-leaved form. In Europe the broad-leaved plants are the more common. Which form is represented by the Broussonet specimen I am at present unable to say, but at any rate this size-variation appears not to be worth nomenclatorial distinction. The robustness of the plant does not correlate with other variations and the intermediate forms are the most common. Even the fruits of this species show a diversity in the prominence of the keels, but this, too, does not correlate with other differences, and sometimes a marked variation is found on an individual plant. When typically developed, the keels are strongly prominent; their lack of development is probably mostly due to a rapid maturation—a ripening before the endocarp is fully formed. Unkeeled fruits invariably have aborted embryos.

From Missouri westward, this species tends to have smaller floating leaves of a more yellowish green than those typical of the east. Correlated with this is a smaller fruit with less strongly developed keels (*P. rotundatus* Hagstr.). However, the typical large green leaf is also common in the west, as well as all degrees of intermediate forms. Also, some specimens with small yellowish leaves may exhibit fruits as strongly keeled as those of the typical eastern plants.

In 1848, Tuckerman described as *P. lonchites* a plant with "stem . . . much branched, . . . Submersed leaves . . . with 6–8 prominent nerves," (making no mention of a

petiole) and "floating leaves delicate, . . . always more or less tapering above and waved above, . . . stipules . . . shortish . . . Nutlets small . . . obscurely tricarinate." He stated that it was "near to P. heterophyllus of authors, (P. gramineus, Fr., Koch.)."[1] The following year he remarked further on his *P. lonchites* and spoke of "a remarkable state of this species . . . In this the stem is simple . . . and the . . . leaves are either all coriaceous and floating, or only the lowest submembranaceous, . . . the whole habit of which accords, often strikingly with that of *P. fluitans;* but its strongly marked fruit at once refers it to the present species. The published description of the fruit of this species was from immature nutlets. The following is taken from perfectly ripe ones . . . The lateral keels are conspicuous when dry . . . The exocarp being removed, the back appears acutely carinate, and a little alate, especially above."[2] It is quite evident from a comparison of the two descriptions and an examination of specimens labeled "*P. lonchites*" by Tuckerman that he was dealing with two separate and distinct species. Plants in the Gray Herbarium which, though not fruiting, otherwise fit his original description perfectly and are labelled "*Potamog. lonchites*" in Tuckerman's hand, have no close relationship to the plants associated with that name by Robbins, Morong and, following them, some other American authors, but are flowing-water forms of *P. gramineus* var. *maximus*. Tuckerman's supplementary description was based on *P. nodosus*, which he mistook to be a state of his *P. lonchites*, as a specimen in the Gray Herbarium clearly shows.

P. rotundatus was based by Hagström on four specimens: one each from Nebraska, California, New Mexico and Mexico. Although referring it to the subsection *Amplifolii*, he states: "I have scarcely met with a species corresponding so nearly to *P. nodosus* as regards the stem-anatomy as this. It differs by the smooth leaf margin, the long lower petioles, the prasinous leaf-colour, the ligules, the styles, and chiefly by the characteristic fruits."[3] In the Gray Herbarium are specimens from three of the collections cited. All lack true submersed leaves. The

[1] Edward Tuckerman, Am. Journ. Sci. ser. 2: 6: 226 (1848).
[2] Edward Tuckerman, Am. Journ. Sci. ser. 2: 7: 351 (1849).
[3] J. O. Hagström, Crit. Res. Pot. 154 (1916).

Nebraska plant (*Rydberg*, no. 1421) has no fruit; the specimen from New Mexico (*Fendler*, year 1847) has fruit which is definitely keeled. The Mexican collection (*Pringle*, no. 1390) alone has the fruits as described by Hagström. That they lack keels is true enough, but that they are quite immature is also evident. Numerous specimens of *P. nodosus* show immature spikes the fruits of which vary greatly in the development of keels. As to the leaf-margin, the denticles on the submersed leaves of *P. nodosus* are so extremely fugacious that they are seldom found in any but the youngest leaves. Young leaves of plants approaching the appearance of *P. rotundatus* have denticles as freely as those of typical *P. nodosus*. The stipules ("ligules") of typical *P. nodosus* are often scarcely if at all keeled, so that the lack of keels on those of *P. rotundatus* is not sufficient for its separation.

The species proposed by Hagström as *P. insulanus* is based on a single specimen from Puerto Rico: *Sintensis*, no. 2537, in the herbarium at Stockholm. Originally identified as *P. pensylvanicus* Willd. (*P. epihydrus* Raf.) by Bennett, this collection (at least the specimen in the Berlin herbarium) became, with *Sintensis*, no. 1025, the type material upon which *P. Nuttallii* var. *portoricensis* Graebner was based. Hagström refers *Sintensis*, no. 1025 to *P. nodosus*, though saying, "dubious . . . probably . . . what I call *P. insulanus*." The two numbers before me show clearly that neither has any affinity to *P. epihydrus* (*P. pensylvanicus* or *P. Nuttallii*), as has already been pointed out by Fernald.[1] The number 1025 is rather definitely *P. nodosus*. The number 2537 in the Gray Herbarium is sterile and with small abnormally developed submersed leaves. It appears to be either an ecological form of *P. nodosus* or possibly a hybrid between *P. nodosus* and some member of the subsection *Lucentes*.

Just what *P. mexicanus* Ar. Benn. is cannot be definitely determined. Bennett's description agrees rather well with *P. nodosus*, except: "Fruit 3/16 in. long by 1/4 in. broad." However, fruits seen by Morong were described by him as being "2 lines long, 1½ lines wide,"[2] less than half as wide, so it can be concluded that Bennett's "1/4 in." is in error. Graebner, who evidently found it convenient to compute his measurements from

[1] M. L. Fernald, Mem. Am. Acad. Arts & Sci. **17**: pt. 1: 119 (1932).
[2] Thomas Morong, Mem. Torr. Club **3**: no. 2: 23 (1893).

Bennett's description, gives "5 mm longi et 6 mm lati."[1] Specimens in the Gray Herbarium and cited by Graebner are sterile, but referable to *P. nodosus*.

P. occidentalis, described by Chamisso and Schlechtendal and credited to Sieber, appears, from the description and excellent illustration of the fruit, to be typical *P. nodosus*.

Just what *P. plantagineus* var. *jamaicensis* Grisebach represents is not determined. From the description and judging from the plants found in Jamaica, it appears to be *P. nodosus*. Further study is needed on the subsection *Nodosi* of Central America and the West Indies.

7. P. natans Linnaeus

Rhizomes white with reddish spots when fresh, buff with dark red spots when dry (these spots often with lighter centers). Stem simple or rarely branched, terete, .8–2 mm. in diameter, with transverse ridges (these also on the rhizome and submersed leaves); stele with the trio-type pattern, the phloem on the inner face of the trio bundle appearing as 2 distinct patches; endodermis well developed, of U-cells; interlacunar and subepidermal bundles present; pseudo-hypodermis 1 cell thick. Submersed Leaves coriaceous, semi-terete, narrowly linear (excluding transition leaves), no differentiation between blade and petiole, tapering at the apex to an obtuse tip, 10–20 cm. long, .8–2 mm. wide; nerves 3–5, obscure. Floating Leaves coriaceous, with long petioles 1–2.5 mm. thick, each having a brownish curved joint-like portion at its junction with the blade; blades ovate to oblong-ovate (sometimes ovate-elliptic), cordate to rounded or rarely tapering at base, apex rounded or with an obtuse mucro, 4–9 (–12) cm. long, 2.5–6 (–6.5) cm. wide; nerves (13–) 23–37, with about one-third of them prominent; lacunae none or obscure. Stipules of submersed leaves clasping the stem, whitish, fibrous, persistent, linear to lanceolate, cucullate at apex in the bud, splitting on maturity and becoming raggedly obtuse, or twisting and becoming acutish, 4.5–9 (–11) cm. long, about 5 mm. wide at base, with 2 well-developed keels and many fine nerves; those of the floating leaves similar but usually broader (up to 12 mm. wide at base). Peduncles as thick as or slightly thicker than the stem, 3–8 cm. long. Spikes in anthesis compact, with 8–14 whorls; in fruit 3–5 cm. long, .9–1.2 cm. thick. Flowers sessile or nearly so; sepaloid connectives greenish, reniform to orbicular, (1.6–) 1.8–2.2 (–2.8) mm. wide; anthers about 1 mm. long. Fruits obovoid, (3–) 3.5–5 mm. long, 2.5–3.5 mm. wide; keels none or rounded or with dorsal keel some-

[1] P. Graebner, in Engler, Pflanzenr. 4: fam. 11: 57 (1907).

what prominent if dried before fully mature; beak short and broad; exocarp sack-like, wrinkled, bright orange drying to buff (greenish when immature); endocarp more or less pitted on each side, and with 2 longitudinal sinuses on the back forming 3 rounded keels, beak linear, about 1 mm. long, loop solid; apex of seed pointing toward the basal end. Plants mostly with strongly developed cordate floating leaves and with the narrowly linear submersed leaves decaying early.

P. natans L., Sp. Pl. **1:** 126 (1753); Morong, Bull. Torr. Club, **13:** 145 (1886), Mem. Torr. Club **3:** no. 2: 13 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 42 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 16 (1909); Hagstr., Crit. Res. Pot. 191 (1916). *P. natans* var. *prolixus*, sensu Am. authors; an Koch?

A common species of lakes and streams, Newfoundland, south to Pennsylvania, west to California, and north to southern Alaska. Map 8. Eurasia. The following, selected from a large series of specimens are representative: Newfoundland: Bishop Falls, Valley of Exploits R., *Fernald, Wiegand & Darlington 4461;* Highlands P., Crabbes, *Kennedy 80;* 4 miles northeast of Port à Port, *Mackenzie & Griscom 10043.* Quebec: Mingan Islands, Saguenay Co., *St. John 90081;* Maria, Bonaventure Co., *Victorin, Rolland & Jacques 33316;* marly pond, Grand R., Gaspé Co., *Collins, Fernald & Pease 5295;* Lac Porc-Épic, Saint-Fabien, *Rousseau 30003;* Black L., Megantic Co., *Fernald & Jackson 11986;* LacTremblant, Labelle Co., *Victorin & Rolland 44070;* Lake Memphremagog, Sargent's Bay, Aug. 1, 1903, *J. R. Churchill;* Ile Verte, Longueuil, Chambly Co., *Rolland 43363;* McGregor L., *John Macoun 85530;* North Wakefield, *J. M. Macoun 4358.* Magdalen Islands: between E. Cape & E. Point, Coffin Island, *Fernald, Long, & St. John 6763.* Prince Edward Island: east of Britain P., Kings Co., *Fernald & St. John 10894.* Nova Scotia: Pottle's L., North Sydney, Cape Breton Co., *Bissell & Linder, 19678;* west of Ingonish, Cape Breton Island, *Nichols 749;* Salmon R., Truro, Colchester Co., *Bean & White 19675;* Middleton, Annapolis Co., *Fernald & Pease 19676;* Wentworth L., Digby Co., *Fernald & Long 23130;* St. John (Wilson's) L., Yarmouth Co., *Fernald, Bartram & Long 23129;* Charcoal, valley of the East R., *St. John 1372.* Maine: Portage L., Aroostook Co., 1881, *Kate Furbish;* Great Works Stream, Clifton, Penobscot Co., *Fernald 2756;* Foxcroft, Piscataquis Co., *Fernald 475;* Baker L., T 7 R 17, Somerset Co., *St. John & Nichols 2106;* Swan P., Oxford Co., July 1892, *J. C. Parlin;* Torrey P., Deer Isle, Hancock Co., *A. F. Hill 2560a;* Stevens P., Liberty, Waldo Co., *Rossbach 60;* Black Duck P., Matinicus, Knox Co., July 13, 1919, *C. A. E. Long;* Sydney, Kennebec Co., *Fernald & Long 12381;* n. of Perley P., Sebago, Cumberland Co., *Fernald, Long & Norton 12382;* Wells, York Co.,

July 1881, *J. Blake.* New Hampshire: Cherry P., Jefferson, Coös Co., *Pease 20073;* Long (Stacy) P., Washington, Sullivan Co., *Fernald & Svenson 745;* Frost P., Jaffrey, Cheshire Co., *B. L. Robinson 494;* Derry, Rockingham Co., Aug. 3, 1926, *C. F. Batchelder;* West Lebanon, Sept. 7, 1891, *G. G. Kennedy;* Bellamy R., Madbury, Strafford Co., *Hodgdon 2640.* Vermont: Pelot's Bay, Lake Champlain, North Hero, Grand Isle Co., Aug. 2, 1899, *Nellie Flynn;* West Barnet, Caledonia Co., Aug. 20, 1884, *F. Blanchard;* Lowell L., Londonderry, Windham Co., *L. A. Wheeler;* Dead Creek, Ferrisburg, Aug. 15, 1881, *E. Faxon.* Massachusetts: Long P., Tewksbury, Middlesex Co., Aug. 24, 1865, herb. *Boott,* also *L. B. Smith 632;* Lower P., Wakefield, Middlesex Co., *Collins 937;* Plymouth, Plymouth Co., Aug. 26, 1913, *S. N. F. Sanford;* Eastham, Barnstable Co., *Collins 3171;* Sutton, Worcester Co., *Anderson, Smith & Weatherby 1166;* Robinson Creek, Pembroke, *Fernald & Svenson, Gray Exsic. 409;* Lake Buel, New Marlboro, Berkshire Co., July 20, 1920, *J. R. Churchill.* Rhode Island: Providence, July 1866, *G. Thurber.* Connecticut: Twin Lakes, Salisbury, Litchfield Co., *Eames & Godfrey 8679;* Dog P., Goshen, Litchfield, Aug. 24, 1913, *Bissell & Weatherby;* Farmington R., Hartland, Hartford Co., *Ogden & Bolan 1565;* Long P., Thompson, Windham Co., *Weatherby 4364;* Mahoney Meadow, Franklin, New London Co., July 27, 1905, *R. W. Woodward.* New York: Pierrepont P., Woodville, Jefferson Co., *House 16979;* Lake Canandaigua, Woodville, Aug. 19, 1884, *Morong;* Spencer L., Spencer, Tioga Co., *E. Moore 1488;* Tioughneoga R., Riverside Park, Cortland Co., *E. L. Palmer 37;* Carpenters P., Fabius, Onondaga Co., *House 1338;* Sodus Bay, Wayne Co., *Killip 6204 & 12258.* New Jersey: Black R., Chester, Morris Co., *Mackenzie 4377;* Swartswood L., Sussex Co., *Griscom & Mackenzie 10685.* Ontario: Ko-Ko-Ko Bay, L. Timagami, *Cain 1045;* Franks Bay, Lake Nipissing, *Chitty 260;* McKay's L., near Ottawa, *Malte 118270;* McGregor Bay, Manitoulin Dist., *Ogden & Bolan 1646;* Cypress Lake Channel, Tobermory, Bruce Co., *Krotkov 7038;* Little Eagle Harbor, Lake Huron, *John Macoun 26840;* Golden L., Renfrew Co., July 28, 1899, *L. M. Umbach;* Dumbell L., Pancake Pt., Algoma Dist., *Taylor, et al. 295.* Michigan: Isle Royale, *Cooper 260;* St. Ignace, Mackinac Co., *Pease & Ogden 24165;* Lake Charlevoix, Ironton, Charlevoix Co., *Ogden & Bolan 1676;* Bessey Creek, Cheboygan Co., *Gates 12217;* Manistee, Aug. 8, 1882, *Morong;* Pine L. near Mich. Ag. Coll., July 25, 1891, *C. F. Wheeler 7;* Thread P., Flint, Aug. 11, 1909, *Sherff;* Kimble L., Vicksburg, Kalamazoo Co., July 3, 1938, *Rapp 2238;* Barton L., Kalamazoo Co., *Hanes 1978;* Park L., Ingham Co., July 22, 1926, *Oosting.* Ohio: Buckeye L., e. of Columbus, *Morris A41;* Put-in-Bay, Aug. 1898, *A. J. Pieters.* Indiana: Wolf L., *Agnes*

Chase 1459; Wolf L., Lake Co., *Lansing 4274;* Bear L., Noble Co., *Deam 49391;* Cheeseborough L., Flint, Steuben Co., *Deam 49360;* Lake Maxinkuckee, *Evermann 1032* (US), also *Scovell & Clark 1032 (271), under direction of Evermann* (F), also *Scovell 26* (US, mixed with *P. amplifolius*). WISCONSIN: Elkhart L., Aug. 28, 1887 and Aug. 4, 1892, *F. H. Schuette;* Pell L., Bloomfield Twp., Walworth Co., *Hotchkiss & Koehler 4193;* Lauderdale, *Bebb 995 & 1008;* Valley of the Wisconsin R., near Rainbow Rapids, *Cheney 1420.* ILLINOIS: Lake Villa, Lake Co., *Gleason & Shobe 179;* Grass L., Lake Co., *Gates 1752.2;* Cedar L., 50 mi. n. of Chicago, *Roush 812;* Ringwood, *Geo. Vasey.* MINNESOTA: Lake Itasca, Clearwater Co., *Grant & Oosting 3203;* Cass L., *Pammel 100;* Minnesota R., Dakota Co., June 1895, *E. P. Sheldon;* Great Crab L., St. Louis Co., Sept. 3, 1919, *Butters;* Green L., Chisago City, *Metcalf 1295;* Swan L., Nicollet Co., *Metcalf 50;* Schultz L., Kandiyohi Co., *Metcalf 2113;* Koronis L., Stearns Co., *Metcalf 1388*, also *Kubichek 115b* (US, mixed with *P. amplifolius*); Little Pine L., Aitkin Co., *Over 17139;* Lizzie L., Ottertail Co., *Kubichek 190;* Bear L., Freeborn Co., *Shunk & Manning 83;* German L., Le Sueur Co., *Shunk & Manning 225;* Lake Charlotte, Wright Co., *Linsdale & Keck 127;* Silver L., Mille Lacs Co., Aug. 1892, *E. P. Sheldon.* IOWA: Spirit L., Dickinson Co., July 31, 1896, *B. Shimek*, also July 29, 1897, *R. I. Cratty;* Round L., Lake Twp., Clay Co., *Hayden 823.* NORTH DAKOTA: Upsilon L., Turtle Mts., St. John, Rolette Co., *Mabbott 459;* Metigoshe L., Turtle Mts., Bottineau Co., *Metcalf 544.* NEBRASKA: Hannah's L., Cherry Co., *Smith & Pound 228;* Hackberry L., Cherry Co., July 20, 1912, *Pool & Folsom*, also *Tolstead 638;* Niobrara Game Reserve, near Valentine, *Tolstead 428;* Swan L., Grant Co., *Rydberg 1652;* Shafer L., Garden Co., *Uhler & Martin 1660;* South Cody L., *Ray Thomson 232.* ALBERTA: n. of Lake Louise, Rocky Mts., *Macoun 68425* (C). MONTANA: Lake McDowell, Glacier Nat'l Park, *Maguire & Piranian 5439;* Avalanche L., Glacier Nat'l Park, *Standley 18500;* Rost L., Big Fork, *Whitford 254*, also *MacDougal 676;* Whitefish L., Aug. 24, 1892, *R. S. Williams.* IDAHO: Lake Pend Oreille, near Hope, *Sandberg, MacDougal & Heller 939;* Lake Pend Oreille, Aug. 1891, *J. B. Leiberg;* valley of Lake Tesemini, Kootenai Co., *Sandberg, MacDougal & Heller 697;* Paradise Creek, Moscow, *Henderson 2717;* Priest L., *Piper 3765*, also *MacDougal 240;* Potlatch R., Nez Perce Co., *St. John et al. 9740;* Warm L., 25 mi. n. e. of Cascade, Valley Co., *Rollins & Chambers 2590;* Fernan L., Coeur d'Alene, *Rust 385.* WYOMING: Jackson's Hole, Lincoln Co., *E. B. & Lois B. Payson 2251;* Grand Encampment, *Aven Nelson 4145.* COLORADO: Laramie R., Larimer Co., Aug. 4, 1891, *C. S. Crandall* (NY); Crested Butte, Aug. 1891, *Cal. Acad. Sci. Herb.* (S). UTAH: Weber R., *Sereno Watson 1131* (G, see also next citation). NEVADA: Ruby

L., *Sereno Watson 1131* (G, NY, US, see also previous citation). New Mexico: Long L., Chusca Mts., San Juan Co., *A. Wetmore 541* (US). Arizona: Marsh L., White Mts., *Goldman 2453* (US); Walker L., San Francisco Mts., *Knowlton 288* (US). California: Fletcher Creek at Pease Place, Devil's Garden, Modoc Co., *L. C. Wheeler 3973;* near Lassen Buttes, Plumas Co., *H. E. Brown 644;* Upper Mud L., Coal Mine Ridge, San Mateo Co., *R. S. Ferris 2043;* Mather, Tuolumne Co., *Keck 1188;* Lakeside, Eldorado Co., June, July 1912, *H. D. Geis;* Lily L., near Fallen Leaf, Lake Tahoe region, Eldorado Co., *Wiggins 6757, 6777 & 6797;* Big Lagoon, Big R., Mendocino Co., *McMurphy 193;* Bear Valley, San Bernardino Mts., *S. B. & W. F. Parish 1435.* Oregon: Salem, *Elihu Hall 486;* Sauvie's Island, Willamette, Multnomah Co., *Howell 365;* Seven Mile Creek, Klamath L., Klamath Co., *Applegate 4489;* w. fork of Illinois R., near Floyd School, Josephine Co., *Abrams 8677;* Port Orford, *Peck 8514;* Quartz Valley, *Coville & Leiberg 224 & 228;* Cape Arago, Coos Co., *House 5044.* Washington: first pond east of summit, Nespelem road, Okanogan Co., *Fiker 1455;* Oyhut, Chehalis Co., *Lamb 1259;* Nooksack R., Lummin Indian Reservation, Whatcom Co., *Muenscher 7643;* Seattle, *Piper 758.* British Columbia: Revelstoke, *John Macoun 3019;* Colquitz R., near Victoria, *John Macoun 88248;* San Juan L., Dist. of Renfrew, *Rosendahl 790;* Chilliwack Valley, *J. M. Macoun 26814;* Griffin L., *Macoun 2971* (C, mixed with *P. epihydrus* v. *Nuttallii*), also *Macoun 3020.* Alaska: Prince of Wales Island, Klawak L., *Mr. & Mrs. E. P. Walker 994;* Ketchikan, *Cowles 1405;* Dundas Bay, *J. P. Anderson 1344;* Sitka, *J. P. Anderson 21*, also *Evans 781.*

P. natans is a familiar species over all the northern half of the United States. Because of its wide range and tendency to fruit freely it is one of the primary foods for wild water-fowl.

Although the American plant seldom attains the robustness so typical of the European plant, there seem to be no characters fundamental enough to separate the two, even as varieties. The fruit of the American plant has a weaker endocarp-beak than that of the European, a fact noted for the American *P. alpinus*, but unlike the case of that plant, the drying of the mesocarp of *P. natans* does not cause any appreciable difference in the shape of the fruits on the two hemispheres. The endocarp loop is invariably solid in the American plant and sometimes shows a cavity in European specimens.

P. natans, like the other broad-leaved species, responds markedly to ecological conditions. Many of these forms have been given names. In fact, some of the names on the labels for

the European plants make habitat-notes quite superfluous. When in quiet water, the floating leaf-blades become broad and definitely cordate; when in a current, the blades are narrower and rounded or cuneate at the base. Flowing water also causes an elongation of the internodes and a marked reduction in the production of inflorescences.

An aquarium plant of *P. natans*, which grew from a seed in my laboratory, showed an interesting sequence of development. The first shoot produced only the linear submersed leaves; the second shoot produced some broad leaves, which were much narrower than normal and narrowly cuneate at base; the third shoot produced the typical broad floating leaves which were cordate at base. Then a number of shoots were sent up at about the same time, the floating leaf-blades of which, however, reverted to the narrow type with cuneate bases. Finally, the branching rhizome sent up numerous shoots, all of which produced submersed leaves only, or a few leaves with slightly dilated tips. Thus from one seed were produced forma *submersus* Glück, var. *prolixus* Koch, and var. *vulgaris* Koch & Ziz (var. *typicus*). The aquarium was not so constructed that var. *terrestris* S. F. Gray might appear.

An interesting form of *P. natans* which grew in the tidal water of Robinson Creek, Pembroke, Massachusetts, has been observed on several occasions by Prof. Fernald, and as it appeared to remain the same, was collected by Fernald and Svenson and distributed from the Gray Herbarium. With its reduced floating leaf-blades, narrowly cuneate at base, on long petioles, and its production of winter buds (collected in October), this is obviously an ecological state. Mr. Weatherby kindly drove me to the locality, but so many changes, attendant on the building of a paved road and a new bridge, have so altered the locality as described by Prof. Fernald that no *P. natans* was found. In such a habitat, where the tidal water rises and lowers twice a day and perhaps at times becomes slightly brackish, no freshwater species of *Potamogeton* can be expected to lead a normal life. That the floating leaves of this plant were submersed at times is evidenced by the non-functional and reduced number of stomates.

Fryer's remarks on "some beautiful seedling forms of *P.*

natans, with lanceolate, oval, and round floating leaves, sufficient to afford examples of several named 'varieties', but unfortunately all growing on *one rootstock* in the instance in which the 'varieties' were most marked!" are of interest here.

American plants labeled "var. *prolixus*" include juvenile and elongated forms of *P. natans* and elongated forms of *P. Oakesianus*. They are always sterile.

8. P. Oakesianus Robbins

Rhizomes whitish with red spots. Stem often branched, terete, .5–1 mm. in diameter; stele with the trio-type pattern, the phloem on the inner face of the trio-bundle appearing as 2 patches; endodermis well developed, of U-cells; interlacunar and subepidermal bundles present; pseudohypodermis absent or 1 cell thick. Submersed Leaves delicate, narrowly linear, obtuse, 5–16 cm. long, (.25–) .3–1 mm. wide; nerves 3. Floating Leaves coriaceous, with long petioles .2–1 mm. thick; blades ovate-elliptical to oblong-elliptical, rounded or tapering at base, obtuse, (1.5–) 2–4 (–5.5) cm. long, 1–2 (–3) cm. wide; nerves (7–) 9–19 (–23), about one-third of them prominent; lacunae none or obscure. Stipules of the submersed leaves clasping the stem, whitish, delicately fibrous, persistent but becoming shreddy, linear, acutish when dry, about 1–3 cm. long; those of the floating leaves larger, 2–4 (–5.5) cm. long, linear or narrowly triangular, strongly fibrous, 2-keeled, at least at base. Peduncles thicker than the stem, .9–1.6 mm. in diameter, 2.5–6 cm. long. Spikes with 3–8 whorls; in fruit 1–3.5 cm. long, .7–.9 cm. thick. Flowers sessile or nearly so; sepaloid connectives 1.3–1.8 (–2.2) mm. wide; anthers about .8 mm. long. Fruits obovoid, 2.5–3.5 (3.7) mm. long, (1.6) 2–2.4 mm. wide; lateral keels rounded, dorsal keel usually prominent and acutish; beak short and broad; exocarp smooth or nearly so, greenish or rarely buff; endocarp with smooth sides, and with 2 rather deep sinuses on the back forming 3 obtuse keels, beak linear, about .8 mm. long, loop solid; apex of seed pointing a little above the basal end. Plants similar to *P. natans* but smaller.

P. Oakesianus Robbins in Gray, Man. Bot. ed. 5: 485 (1867); Morong, Mem. Torr. Club **3:** no. 2: 14 (1893); Taylor, N. Am. Fl. **17:** pt. 1: 16 (1909); Hagström, Crit. Res. Pot. 196 (1916). *P. Purshii* Tuckerm. sensu Graebn. in Engler, Pflanzenr. **4:** fam. 11: 45 (1907); ? Tuckerm., Amer. Journ. Sci. ser. 2: **6:** 228 (1848), see Fernald, Mem. Am. Acad. Arts & Sci. **17:** pt. 1: 121 & 122 (1932).

Shallow pools and edges of quiet ponds, Newfoundland, Anticosti, Magdalen Islands, Nova Scotia, eastern New Brunswick,

Maine, south to New Jersey, west to central New York, and local in Michigan, Wisconsin, and western Ontario. MAP 9. NEWFOUNDLAND: Quirpon Island, Straits of Belle Isle, *Wiegand, Gilbert & Hotchkiss 27339;* Grand Falls, *Fernald, Wiegand & Darlington 4464 & 4465;* Blomidon ("Blow-me-Down") Mts., *Fernald & Wiegand 2436;* Lookout Mt., Bonne Bay, *Fernald, Long & Fogg 1208;* McCleman's P., Crabbes, *R. B. Kennedy 543;* Port aux Basques, *Fernald, Long & Dunbar 26217.* QUEBEC: Les Trois Lacs, Laurentides, *Victorin, Rolland & Jacques 33639;* Rivière Noire, Portneuf Co., *Rousseau 25814;* Matamek R. Dist., North Shore, *Bowman 392.* ANTICOSTI: Ellis Bay, *Macoun 2993.* MAGDALEN ISLANDS: Coffin Island, *Fernald, Long & St. John 6764 & 6765;* Cap-de-l'Est, Ile de la Grande-Entrée, *Victorin & Rolland 9922.* NEW BRUNSWICK: Lac Fox Creek, Westmorland Co., *Victorin, Rolland & Jacques 44749;* Lily P., Southern Head, Grand Manan, Charlotte Co., *Knowlton & Weatherby 6632.* NOVA SCOTIA: Taylor's L., Sunny Brae, Pictou Co., *St. John 1373;* Clyde R., Shelbourne Co., *Prince & Atwood 1318* (S); Goose L., Argyle, Yarmouth Co., *Fernald & White 19680;* Petpeswick, Musquodoboit Harbour, Halifax Co., *Rousseau 35293;* Five-Island L., Hants Co., *Fernald, Bartram & Long 23131;* Lena L., St. Paul Island, *Perry & Roscoe 38.* MAINE: Haley P., Rangeley, Franklin Co., Sept. 1, 1894, *Furbish;* Gilead, Oxford Co., 1897, *Furbish;* Jordan P., Hancock Co., Sept. 10, 1898, *E. L. Rand;* Hackmatack Swamp, Isle au Haut, Knox Co., *A. F. Hill 1222;* Southport, Lincoln Co., *Fassett 18803;* Perley P., Sebago, Cumberland Co., *Fernald, Long & Norton 12384;* Lily P., East Limington, Limington, York Co., *Fernald, Long & Norton 12383.* NEW HAMPSHIRE: Connecticut R., Northumberland, Coös Co., *Pease 12171;* Wheeler P., Shelbourne, Coös Co., Aug. 31, 1918, *Deane;* Merrimack, Hillsboro Co., June 19, 1918, *Batchelder;* Stonehouse P., Barrington, Strafford Co., *Hodgdon 599.* VERMONT: Grout P., Stratton, Windham Co., *Eggleston 2111;* also Sept. 1, 1931, *R. J. Eaton.* MASSACHUSETTS: So. Natick, Middlesex Co., Sept. 15, 1881, *Morong;* Wellesley, Norfolk Co., July 20, 1908, *Wiegand;* Plymouth, Plymouth Co., June 24, 1895, *J. W. Blankinship;* Wellfleet, Barnstable Co., *Fernald & Fogg 505;* pond between Lizzie's P. and Goose P., Chatham, Barnstable Co., *Fernald 15955;* Edgartown, Dukes Co., *Seymour 1487;* Nantucket, Nantucket Co., 1886, *L. L. Dame;* Uxbridge, Worcester Co., Aug. 28, 1851, (TYPE in herb. N. Y. Bot. Gard., cotypes in F, G, NE) and Aug. 18, 1870, *Robbins,* also June 5, 9, & 24, 1876, *Morong;* Lake Chaubunagungamaug, Webster, Worcester Co., *Ogden & Bolan 1562;* Spectacle P., Sandisfield, Berkshire Co., June 29, 1912, *R. Hoffmann.* CONNECTICUT: Middlebury, New Haven Co., Sept. 14, 1901, *Harger;* Stafford, Aug. 1897, herb. *E. L. Morris.* NEW

York: Quiver P., Fourth L., Fulton Chain, Adirondack Mts., *Killip 12574* (US, mixed with *P. epihydrus* v. *Nuttallii*, G, not mixed); Brandy Brook Flow, Cranberry L., St. Lawrence Co., *Muenscher & Maguire 1711;* Big Moose L., Herkimer Co., *Muenscher & Maguire 1716;* Fall Creek, Tompkins Co., *Dudley;* Deep P., Wading R., Long Island, *E. S. Miller;* Rock P., Adirondacks, Aug. 5, 1884, *Morong;* McDonough, July 26, 1886, *F. V. Coville.* New Jersey: Pump Branch of Albertson Brook, Ancora, Camden Co., *J. W. Adams 511;* Magnolia L., Ocean View, Cape May Co., Sept. 29, 1921, *H. B. Meredith;* Estellville, Atlantic Co., July 4, 1883, *C. A. Gross.* Ontario: Sand Pt., Algoma Dist., Lat. 47° 00′ N., Long. 84° 45′ W., *Taylor et al. 297* (C). Michigan: bog near Rock R., Alger Co., *Fernald & Pease 3066;* Au Train, Alger Co., *Pease & Ogden 25135;* Crooked L., Clyde Twp., Allegan Co., Aug. 18, 1937, *D. L. Allen;* Crooked L. Marsh, Allegan Co., Aug. 4, 1938, *W. G. Erwin;* ½ mi. s. w. of West L., Portage Twp., Kalamazoo Co., *Hanes 407.* Wisconsin: Potter's Cranberry Farm, Cutler, Juneau Co., Sept. 23, 1932, *J. H. Steenis* (G); Valley of the Wisconsin R., near Grand Rapids, *Cheney 3610* (NY).

P. Oakesianus has the general appearance of *P. natans* except that it is uniformly smaller in all its parts. There are fundamental differences, however, chiefly in regard to the fruit. The fruit, besides being smaller, lacks the puckered, buff epicarp of *P. natans* and is, instead, stretched and smooth and usually green. The fruits also differ from those of *P. natans* by having 3 prominent keels. The other differences are mainly those correlated with size. While the submersed leaves of *P. natans* are generally borne on the single main stem, those of *P. Oakesianus* are on branches.

9. P. gramineus Linnaeus (American varieties)

Rhizome buff, often suffused or spotted with red, variable in thickness. Stem much branched, terete .5–1 mm. in diameter; stele with the oblong-type pattern with but 1 central bundle (rarely with 2) and usually but 1 lateral bundle on each side; endodermis of U-cells strongly thickened on the inner and lateral faces; interlacunar bundles strongly developed but only in the outer interlacunar circle; subepidermal bundles present or absent; pseudo-hypodermis absent or 1 cell thick. Submersed Leaves linear to linear-lanceolate or lance-elliptical (sometimes oblanceolate), 1–9 (–13) cm. long, (.1–) .2–1 (–1.5) cm. wide, tapering gradually to a sessile base; apex acute, usually sharp-pointed; nerves 3–9 (–11); lacunae of 1 or 2 rows along

midrib, mostly obscure; margins with fugacious 1-celled translucent denticles. FLOATING LEAVES coriaceous, blades ovate to elliptical (rarely subrotund), 1.5–5 (–7) cm. long, 1–2 (–3) cm. wide; apex obtuse or bluntly mucronate; base cuneate or rounded; petioles 2–10 (–15) cm. long, mostly longer than the blades; nerves 13–17 (–23); lacunae obscure. STIPULES persistent, obtuse and slightly cucullate at apex, those of the submersed leaves and branches .5–3 cm. long, 1–2 mm. wide at base, faintly 2-keeled, with 8 to 30 finer nerves, those of the floating leaves broader. PEDUNCLES at base about same thickness as stem, sometimes clavate, 2–10 (–30) cm. long. SPIKES in anthesis usually rather compact, of 5–10 whorls of flowers; in fruit cylindric and crowded, 1–2.5 cm. long, .6–.8 cm. thick. FLOWERS sessile or on pedicels up to .5 mm. long; sepaloid connectives orbicular to oval, blades (.7–) 1.2–1.6 (–2.3) mm. wide, claws (.2–) .4–.8 (–1) mm. long; anthers oblong .6–1 (–1.1) mm. long. FRUITS mostly obovate, 1.7–2.5 (–2.8) mm. long (excluding beak), (1.4–) 1.6–2 (-2.3) mm. wide, keels usually strongly evident, but often obscured by the loose exocarp, beak facial, short and curved toward the back; exocarp usually loose, green or rarely tawny; endocarp with keels low and obtuse, beak linear, weak, .3–.5 mm. long, loop solid; apex of seed pointing .3–.7 mm. above the basal end. A variable species characterized by a stem with many lateral compound branches bearing numerous small leaves. Among the many variants of *P. gramineus*, the following seem worthy of recognition:

1. Principal submersed leaves narrowly elliptic to oblanceolate, (1–) 1.5–9 (–13) cm. long, .2–1 (–1.5) cm. wide, 5–10 times as long as broad, or if more than 10 times, then not less than 6 cm. long, sides not parallel; nerves (3–) 5–9.
   2. Principal submersed leaves (1–) 1.5–4.5 (–6.5) cm. long, .2–.6 (–.8) cm. wide; nerves 5–7 ..... 9a. var. *typicus*.
   2. Principal submersed leaves (3–) 6–9 (–13) cm. long, .6–1 (–1.5) cm. wide; nerves 7–9 (–11) ..... 9b. var. *maximus*.
1. Principal submersed leaves linear, (1–) 1.5–3.5 (–5.5) cm. long, .1–.25 (–.3) cm. wide, 10–20 (–30) times as long as broad, sides essentially parallel for most of their length, tapering at apex to an acute tip; nerves 3 ..... 9c. var. *myriophyllus*.

9a. P. GRAMINEUS L. var. **typicus**

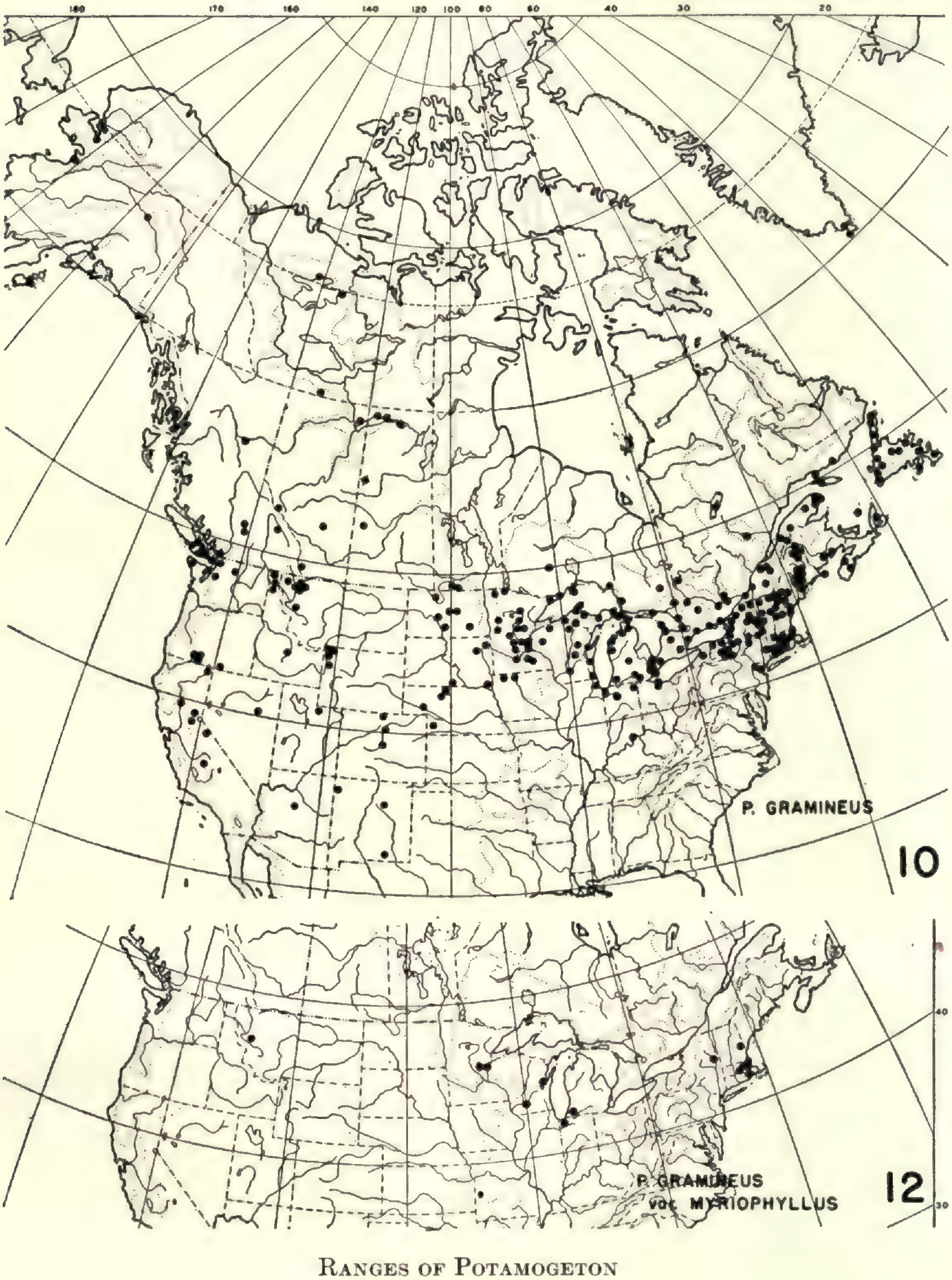
P. gramineus L., Sp. Pl. **1:** 127 (1753); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 84 (1907). *P. Proteus heterophyllus* C. & S., Linnaea **2:** 202 (1827). *P. gramineus* var. *graminifolius* Fries, Novit. Fl. Suecicae 36 (1828), and subsequent Am. authors. *P. heterophyllus* sensu Morong, Mem. Torr. Club **3:** no. 2: 23 (1893); Taylor, N. Am. Fl. **17:** pt. 1: 19 (1909); not Schreb. *P. heterophyllus* forma *graminifolius* Morong, Mem. Torr. Club **3:** no. 2: 24 (1893). *P. heterophyllus* forma *longipedunculatus* Morong,

Mem. Torr. Club **3:** no. 2: 24 (1893), at least in part. *P. gramineus* var. *longipedunculatus* Graebn. in Engler, Pflanzenr. **4:** fam. 11: 88 (1907). *P. heterophyllus* forma *terrestris* Robinson & Fern., Gray's Man., ed. **7:** 74 (1908). *Spirillus heterophyllus* Nieuwl., Am. Mid. Nat. **3:** 17 (1913). *P. gramineus* forma *longipedunculatus* House, Bull. N. Y. State Mus. **254:** 53 (1924), at least in part. *P. gramineus* forma *terrestris* Carpenter, Fl. Vt., 3rd rev. ed.: 25 (1937). *P. gramineus* var. *lacustris* sensu Hultén, Fl. Alaska and Yukon, pt. 1: 100 (1940).

Lakes and streams, southern Greenland to Alaska, south to New Jersey, Ohio, Indiana, Illinois, Iowa, Nebraska, New Mexico, Arizona, and California. Map 10. Eurasia. Of the very numerous collections of this variety the following are the most typical in the areas cited: Greenland: Igaliko, 1828, *J. Vahl*, also July 23, 1888, *Rosenvinge 2990;* Igaliko-Fjord, Qagssiarssuk, Aug. 5, 1925, *A. E. & M. P. Porsild;* Frederiksdal, July 25, 1925, *A. E. & M. P. Porsild.* Newfoundland: Bear Cove, Straits of Belle Isle, *Wiegand & Pease 27340;* Flower Cove, Straits of Belle Isle, *Fernald & Long 27345;* Birchy Cove (Curling), *Fernald, Wiegand & Kittredge 2445 & 2447;* Bonne Bay, Main R., *Fernald & Long 1210;* Highlands Brook, Crabbes, *Kennedy 82.* Quebec: Lake Mistassini, *Macoun 2980 & 2984;* Trout P., mouth of Grand R., *Collins, Fernald & Pease 4013½, 5287, 5314 & 5314A;* Lotbiniere, Lotbiniere Co., *Victorin, Rolland & Jacques 33714;* New Richmond, Bonaventure Co., *Victorin, Rolland & Jacques 33855;* Lake Temiscouata, *Victorin 526;* Farm Point, Gatineau R., *J. M. Macoun 80929;* Ottawa R. at Gatineau Point, *Malte 118257;* Blue Sea L., *Malte 118265;* Lac Wattopekah, St. Georges de Windsor, Richmond Co., *Louis-Marie, Laporte & Dudemaine 1403;* Black L., Megantic Co., *Fernald & Jackson 11988.* Anticosti: Ruisseau Harvey, Aug. 17, 1917, *Victorin 4195.* Magdalen Islands: Amherst Island, *St. John 1758* (toward var. *maximus*). Nova Scotia: Warren L., Cape Breton I., *Nichols 876;* George R., Cape Breton I., *Bissell & Linder 19692;* Little R., Tiddville, Digby Co., *Fernald & Long 19690.* New Brunswick: Nerepis R., Westfield, Kings Co., *Fernald 1619;* Hammond R., Hammond, Kings Co., *Svenson & Fassett 3046;* Lake Utopia, *Wetmore 2988;* Little Tobique L., *Hay 2989.* Maine: Fort Fairfield, Aroostook Co., *G. D. Chamberlain 1770;* Fish River L., Aroostook Co., *Ogden 1716;* Pushaw P., Glenburn, Penobscot Co., *Ogden & Steinmetz 1545;* Indian P., St. Albans, Somerset Co., *E. C. & Edith B. Ogden 2013;* Pitcher P., Northport, Waldo Co., *Ogden & Steinmetz 1612;* Wilson P., Wilton, Franklin Co., *Ogden & Marston 1698;* Presumpscot R., North Windham, July 9, 1899, *W. C. Kendall.* New Hampshire: Dead R., Berlin, Coös Co., *Pease 22754;* Lake Winnipisaukee near Melvin Village, Aug. 15, 1904,

M. A. Day. VERMONT: Little Otter Creek, Lake Champlain, Ferrisburg, Aug. 7, 12, and 20, 1880, *C. E. Faxon;* Queechee Gulf, July 29, 1890, *G. G. Kennedy;* Fairfield P., Fairfield, Franklin Co., *Blake 3071.* MASSACHUSETTS: Mystic L., July 4, 1852, *Robbins;* Fresh P., Cambridge, August 6, 1883, *Morong;* Sandy P., Lincoln, Sept. 15, 1868, herb. *Wm. Boott;* Natick, Aug. 14 and 17, 1883, *Morong.* CONNECTICUT: Selden's Cove, Lyme, Aug. 31, 1900, *C. B. Graves;* Pistapaug P., Durham, *Weatherby 3389;* several collections from Lake Saltonstall, E. Haven are typical *P. gramineus*, others from the same lake approach var. *myriophyllus*, still others approach var. *maximus* or are perhaps *P. gramineus* × *P. illinoensis.* NEW YORK: Butterfield L., Jefferson Co., *Muenscher & Maguire 1690;* Osgood P., Franklin Co., *Muenscher & Maguire 778;* Otsego L., Otsego Co., *Muenscher & Curtis 4880;* Bullhead P., Minerva, Essex Co., *House 15193;* Myers Pt., Ludlowville, Tompkins Co., Aug. 13, 1884, *W. R. Dudley.* NEW JERSEY: Morris P., Sept. 13, 1887, *N. L. Britton;* Morris L., Aug. 10, 1894, herb. *W. M. Van Sickle;* Lake Hopatcong, Morris Co., *C. F. Austin* (C, mixed with *P. gramineus* var. *maximus;* NY, not mixed); Swartzwood L., Sussex Co., *Griscom & Mackenzie 10686.* ONTARIO: Belleville, *Macoun 2985;* Great Opeongo L., Algonquin Park, *Macoun 22216 & 22217;* McGregor Bay, Manitoulin Dist., *Ogden & Bolan 1644 & 1645;* near Dyer Bay, Bruce Pen., *Pease & Ogden 24911;* Gillies L., Bruce Pen., *Cain 938;* Ko-Ko-Ko Bay, Lake Timagami, *Cain 1039 & 1042.* MICHIGAN: Isle Royale, *Cooper 69;* Seneca L., Keweenaw Co., *Hermann 8286;* Brevort L., Moran, Mackinac Co., *Ogden & Bolan 1680;* Lake Charlevoix, Ironton, Charlevoix Co., *Ogden & Bolan 1677;* Crystal L., Montcalm Co., July 1900, *C. F. Wheeler;* Manistee, Aug. 14, 1884, *Morong;* Pearl L., Benzie Co., *McAtee 3076.* OHIO: Sandusky Bay, July 20, 1895 and Sept. 2, 1898, *E. L. Moseley;* Put-in-Bay, Aug. 1898, *A. J. Pieters.* INDIANA: Wolf L., Hammond, *Agnes Chase 1707;* Clarke, Aug. 28, 1897 and June 29, 1898, *L. M. Umbach;* Lake Maxinkuckee, *Scovell 44*, also *Scovell & Clark 1221*, also *Evermann 1221.* WISCONSIN: Pell L., Bloomfield Twp., Walworth Co., *Hotchkiss & Koehler 4194;* near State House, Trout Lake, Vilas Co., *Fassett 9067 & 9069;* Green Bay, Big Suamico, Aug. 28, 1891 and July 31, 1893, *J. H. Schuette.* ILLINOIS: Edgewater, June 7, 1890, *L. N. Johnson;* Rogers Park, June 7, 1890, herb. *W. H. Dunham.* MANITOBA: 4 mi. w. of Hamiota, *Macoun & Herriot 76868;* Killarney, *Macoun 16441.* MINNESOTA: Green L., Kandiyohi Co., *Metcalf 2050;* Itasca Park, De Soto L., Becker Co., *Grant & Oosting 3272 & 3276;* Snail L., Ramsey Co., *Oosting 28166;* Horn L., Anoka Co., *Oosting 291 & 28100;* Muskeg Bay, Lake of the Woods, Warroad, Roseau Co., *Hotchkiss & Jones 417;* Long L. near Ely, St. Louis Co., *Hotchkiss & Jones 4083;* Pleasant L.,

Stearns Co., *Linsdale & Keck 1;* Dudley L., Rice Co., *Keck & Stilwill 373 & 379;* Birch L., Sherburne Co., *Kubichek 101;* Fish L., Chisago Co., *Kubichek 66;* Borden L., Garrison Twp., Crow Wing Co., *Hotchkiss & Jones 4112.* Iowa: Armstrong, Emmet Co., Aug. 8, 1891, June 20, 1897, and Aug. 21, 1897, *R. I. Cratty;* Lost Island L., Freeman Twp., Clay Co., *Hayden 821.* North Dakota: King Slough, s. of Bismark, *Metcalf 345;* Doctor L., Drake, *Mabbott 423;* Spiritwood, *Bergman 443;* Leeds, Benson Co., Aug. 2, 1899, Aug. 21, 1899, and Aug. 16, 1915, *J. Lunell.* South Dakota: South Bass P., Cottonwood L., Spink Co., *Over 17138;* eastern Day Co., *Over 14466.* Nebraska: Pelican L., *Thomson 153;* Red Willow L., *Thomson 361 & 365;* Enders L., *Thomson 16;* Dewey L., *Tolstead 615;* Shafer L., Garden Co., *Uhler & Martin 1656.* Mackenzie: Mosquito Creek and Driftwood R., Great Bear L., 66° 55′ N. 121° 20′ W., July 6–8, 1928, *A. E. & R. T. Porsild;* Edna Travers Bay, Great Bear L., 66° 25′ N. 117° 40′ W., *A. E. & R. T. Porsild.* Saskatchewan: vicinity of William Pt., Lake Athabasca, 59° 7′ 30″ N. 109° 19′ W., *Raup 6849;* Little Buffalo L., *J. M. Macoun 2975;* s. of Battleford, *Macoun 2981.* Alberta: east end of Crow's Nest Pass, Rocky Mts., *Macoun 23180;* Sand Pt., n. shore of Lake Athabasca, *Raup & Abbe 4614.* Montana: Mud L., Bigfork, Flathead L., *M. E. Jones 9293;* Flathead L., Big Fork, Flathead Co., *G. B. & R. P. Rossbach 17;* Whitefish L., Aug. 24, 1892, *R. S. Williams;* Lower Two Medicine Lakes, Glacier Nat'l Park, *Maguire 484;* Echo L., *MacDougal 639.* Idaho: Priest L., *MacDougal 241;* Lake Pend Oreille, *Sperry & Martin 719,* also *Henderson 4576;* Lake Pend Oreille, near Hope, *Sandberg, MacDougal & Heller 955 & 1026.* Wyoming: Shoshone Creek, Yellowstone, Aug. 23, 1878, *C. Richardson;* Yellowstone L., Yellowstone Park, *Tweedy 411;* Leighs L., Jacksons Hole, *Merrill & Wilcox 902.* Colorado: Estes Park, Lorimer Co., *Beetle 2341;* South Park, *Wolf 961;* near Boulder, Boulder Co., *Tweedy 4978.* Utah: Grassy L., Goodman Ranch, Bear R. valley, Uinta Mts., Summit Co., *Hermann 5781.* Nevada: Ruby L., *Watson 1134.* New Mexico: Petersen Reservoir, Montezuma (Hot Springs), San Miguel Co., *Drouet & Richards 3309;* Chusca Mts., San Juan Co., *Wetmore 550;* Dark Canyon, Guadalupe Mts., *Standley 40649.* Arizona: Mormon L., *MacDougal 80* (toward var. *maximus*). California: Little Hot Springs Valley, Modoc Co., Aug. 18, 1899, *M. S. Baker;* vicinity of Truckee, *A. E. Hitchcock 260;* Truckee R. watershed, Sierra Nevada range, *Benson 4013.* Oregon: Bear Flat, Lake Co., *Leiberg 751;* Guano Ranch, Lake Co., *Coville 602.* Washington: Lake Washington, Mercer Island, King Co., *Thomson 7589;* Ozette L., Clallam Co., *Otis 1584;* Blakeley Island, San Juan Islands, *S. M. & E. B. Zeller 1237;* Falcon Valley, Aug. 1, 1885, *W. N. Suksdorf* (toward



RANGES OF POTAMOGETON

var. *myriophyllus*). British Columbia: Kamloops, *Macoun 2974;* Wellington, Vancouver Island, *John Macoun 88254;* Sproat L., Albernie, Vancouver Island, *Carter 505.* Alaska: Yes Bay, *Howell 1668;* Fairbanks, *L. J. Palmer 1866.*

9b. P. gramineus L. var. maximus Morong ex Bennett

Var. *maximus* Morong ex Bennett, Journ. Bot. **19:** 241 (1881). *P. lonchites* Tuckerm., Am. Journ. Sci. ser. 2: **6:** 226 (1848), not Tuckerm., ibid ser. 2: **7:** 350 (1849) and subsequent Am. authors. *P. gramineus* var. *maximus* Morong, Bull. Torr. Club **13:** 155 (1886), without description. *P. heterophyllus* forma *maximus* Morong, Mem. Torr. Bot. Club **3:** no. 2: 25 (1893). *P. gramineus* var. *maximus* Graebn. in Engler, Pflanzenr. **4:** fam. 11: 88 (1907). *P. heterophyllus* in part, Taylor, N. Am. Fl. **17:** pt. 1: 19 (1909). *P. gramineus* f. *Wolfgangii* sensu Hagstr., Crit. Res. Pot. 209 (1916), as to American citations. *P. gramineus* f. *jemtlandicus* sensu Hagstr., Crit. Res. Pot. 209 (1916), as to American citations.

Lakes and streams, often in flowing water, with the typical variety and having essentially the same range in North America. Map 11. Among many collections, the following are the most representative from the areas cited: Labrador: 18 mi. up Naskaupi R., Lake Melville Dist., *R. H. Wetmore 103096.* Newfoundland: Rushy P., Exploits R., *Fernald, Wiegand, Bartram & Darlington 4477;* Lewisport, Notre Dame Bay, *Fernald, Wiegand & Darlington 4480.* Quebec: Lac des Quinze (Baie Gilies), Temiscaming-Abitibi, *Victorin 8194 & 8195;* Roberval, July 16, 1892, *Geo. G. Kennedy;* Deschenes, near Hull, *Malte 118263;* Lac Saint-Jean, *Victorin 16064.* Anticosti: Rivière McKane, *Victorin & Rolland 27095;* Pointe de l'Est, *Victorin & Rolland 27094.* New Brunswick: Titusville, *Brittain 2987;* near St. John R., Connors, *Pease 2589.* Nova Scotia: Salmon R., Truro, Colchester Co., *Bean & White 22962.* Maine: Aroostook R., Ft. Fairfield, July 18, 1893, *Fernald;* St. John R., Ft. Kent, *Mackenzie 3613;* Dead R., Somerset Co., *Fernald & Strong 477;* stream below Dwinall P., Winn, Penobscot Co., *Steinmetz 365;* Stillwater R., Old Town, Penobscot Co., *Ogden & Steinmetz 1602;* Orland R., Orland, Penobscot Co., *Ogden & Marston 1694.* New Hampshire: Connecticut R., Walpole, *Fernald 436;* Connecticut R., near Hanover, July 26 and Aug., 1876, *H. G. Jesup* (not typical). Vermont: Little Otter Creek, Lake Champlain, Aug. 7, 1880, herb. *E. & C. E. Faxon* (not typical). Massachusetts: Charles R., Dedham, July 14, 1879 and July 16, 1880, *Morong,* also Aug. 2, 1880, *C. E. Faxon;* Charles R., S. Natick, July 14, 1879 and Sept. 5, 1882, *Morong;* Charles R., Needham, *Tuckerman;* Ashland, July 9, 1879, herb. *Morong.* Connecticut: Quinnipiac R. at Old Turnpike,

Southington, Aug. 17, 1900 and Aug. 17, 1901, *C. H. Bissell;* Housatonic R., near Lake Zoar, Southbury, *E. H. Eames 11745.* NEW YORK: Saranac R., Adirondacks, July 31, 1884, *Morong;* French Creek, Clayton, Jefferson Co., *Muenscher & Maguire 1693;* Hudson R., below Glen Falls, Warren Co., *Muenscher & Lindsey 2769;* Song L., Cortland Co., *Muenscher & Curtis 4841;* Buffalo, *Clinton 5.* NEW JERSEY: Delaware R., Hunterdon Co., Sept. 19, 1885, *T. C. Porter;* Lake Hopatcong, *C. F. Austin* (C, mixed with *P. gramineus* var. *typicus*). PENNSYLVANIA: Penn's Creek at "Swinging Bridge," Selinsgrove, Snyder Co., *Moldenke 4207.* ONTARIO: Dog R., above Michipicoten, *John Macoun 97;* Ottawa R., Rockliffe, *John Macoun 85536;* Ottawa R., *Harrington 99086 & 99102;* Templeton, *Scott 16444.* MICHIGAN: St. Clair R., near Port Huron, *Dodge 155;* Sault R., near Sault Sainte Marie, Aug. 11, 1910, *J. R. Churchill* (not typical). OHIO: Sandusky Bay, Aug. 19 and Aug. 31, 1898, *A. J. Pieters* (not typical, perhaps *P. gramineus* × *P. illinoensis*). WISCONSIN: Wisconsin R., near Lac Vieux Desert, *Cheney 683;* Green Bay near Big Suamico shore, Brown Co., July 11, 1886, *J. H. Schuette* (not typical, perhaps *P. gramineus* × *P. illinoensis*). MINNESOTA: Vermilion L., July 28, 1886, *L. H. Bailey,* also *Arthur, Bailey & Holway B46, B69 & B403;* Garden Island, Lake of the Woods, *MacMillan & Sheldon 1332;* near mouth of Brule R., Cook Co., *Rosendahl & Butters 4638.* IOWA: Armstrong, Emmet Co., July 11 and Aug. 21, 1897, *R. I. Cratty.* NORTH DAKOTA: Leeds, Benson Co., July 2, 1906, *J. Lunell.* MACKENZIE: Edna Travers Bay, Great Bear L., Aug. 8, 1928, *A. E. & R. T. Porsild.* SASKATCHEWAN: along Grand Trunk Pacific R. R., Yorkton, *Macoun & Herriot 76869.* ALBERTA: Murdock Creek Dist.. Wood Buffalo Park, *Raup 1546;* L. Mamawi, Wood Buffalo Park, *Raup 1548.* MONTANA: Midvale, *Umbach 457.* IDAHO: Moose Creek, near Big Springs, Fremont Co., *G. B. & R. P. Rossbach 20.* WYOMING: Obsidian Creek, Yellowstone Nat'l Park, *Aven & Elias Nelson 6061.* COLORADO: Trout L., near Lizard Head Pass, San Miguel Co., *Maguire, Piranian & Richards 12771.* UTAH: Salt Lake City, *M. E. Jones 1304;* Dry L., Cache Co., *Maguire 13149.* NEW MEXICO: Chusca Mts., San Juan Co., *Wetmore 549.* ARIZONA: Crater L., San Francisco Mts., Aug. 1886, *Lemmon Herbarium.* CALIFORNIA: Lily L., near Fallen Leaf, Lake Tahoe region, Eldorado Co., *Wiggins 6775.* WASHINGTON: Tumwater Canyon, Wenatchee R., *Sandberg & Leiberg 524;* Camas Land, Wenatchee Mts., Chelan Co., *Thompson 11768.* BRITISH COLUMBIA: Shawnigan L., Vancouver Island, *John Macoun 88253.* ALASKA: Sitka, *Evans 780;* Selawik L., *L. J. Palmer 638* (US, mixed with *P. Richardsonii*).

9c. P. GRAMINEUS L. var. MYRIOPHYLLUS Robbins

Var. *myriophyllus* Robbins in A. Gray, Man. ed. 5: 487 (1867). *P. heterophyllus* forma *myriophyllus* Morong, Mem. Torr. Club **3:** no. 2: 24 (1893). *P. heterophyllus* forma *minimus* Morong, Mem. Torr. Club **3:** no. 2: 25 (1893). *P. gramineus* var. *myriophyllus* Graebn. in Engler, Pflanzenr. **4:** fam. 11: 87 (1907); Hagstr., Crit. Res. Pot. 209 (1916). *P. gramineus* var. *minimus* Graebn. in Engler, Pflanzenr. **4:** fam. 11: 89 (1907). *P. heterophyllus* Taylor, N. Am. Fl. **17:** pt. 1: 19 (1909), in part. *P. gramineus* forma *myriophyllus* House, N. Y. State Mus. Bull. **254:** 53 (1924).

Quiet water, local in New Hampshire, Massachusetts, Rhode Island, New York, Michigan, Indiana, Wisconsin, Minnesota, and Montana. MAP 12. Although many collections approach this variety, only the following are considered typical: NEW HAMPSHIRE: Lake Winnepesaukee, 1876, *W. F. Flint.* MASSACHUSETTS: Spot P., Stoneham, Aug. 20, 1865, herb. *Wm. Boott*, also July 27, 1876, *Morong*, also Aug. 13, 1880, herb. *E. & C. E. Faxon;* Spot P., Wyoming, Aug. 13, 1880, herb. *C. E. Faxon;* Spot P., Melrose, Aug. 13, 1880, *Edwin Faxon;* Winter P., Winchester, Middlesex Co., *Fernald & Svenson 744;* Wakefield, Sept. 13, 1876, *J. W. Chickering;* Lake Pattaquatic, Ware, Aug. 25, 1905, *E. L. Morris.* RHODE ISLAND: Apponaug P., Apponaug, Oct. 14, 1865, Robbins (TYPE in NY), also Aug. 1879, Sept. 29, 1879 and Aug. 26, 1880, *Morong*, also Aug. 26, 1880, *E. Faxon*, also Aug. 26, 1880 herb. *E. & C. E. Faxon* ("Kingston" appears on the labels, which is an error, for the collection was made at Apponaug in the town of Warwick), also Aug. 24, 1881, *E. Faxon*, also Aug. 25, 1881, *Morong;* Gorton's P. (Apponaug P. of early botanical collectors), Apponaug, town of Warwick, *E. C. & E. B. Ogden 1765.* NEW YORK: Mud P., Pattens Mills, Warren Co., Aug. 25, 1918, *S. H. Burnham;* Friends L., Warren Co., *Muenscher & Lindsey 2775.* MICHIGAN: Sister Lakes, Van Buren Co., *De Selm 22.* INDIANA: Dune Park, *Peattie 2305.* WISCONSIN: Oneida Reservation, Sept. 8, 1881, *J. H. Schuette;* Devils L., Sauk Co., *Fassett 14262.* MINNESOTA: Lake Mora, Kanabec Co., July 1892, *E. P. Sheldon;* Milaca, Mille Lacs Co., July 1892, *E. P. Sheldon.* MONTANA: Bitterroot R., s. w. of Missoula, Missoula Co., *Barkley 1996.*

The extremely variable *P. gramineus* which often approaches in appearance its near relative, *P. illinoensis*, is further complicated by the fact that it hybridizes with most (perhaps all) of the other broad-leaved species of the genus and even one (perhaps more) linear-leaved species. In North America three varieties can be recognized which, though distinct in their extreme de-

velopments, intergrade freely. The variety that appears to be identical with the one upon which the species is based (var. *typicus*) is by far the most common, and is rather widespread in both Europe and North America. Its much branched stem has usually an abundance of small elliptic-lanceolate submersed leaves which distinguish it from all other species of *Potamogeton* as well as from the other varieties of the same species.

The variety *myriophyllus* has a stem even more branched and the leaves still smaller but with parallel margins. This would seem to be but an ecological form were it not found in somewhat different habitats, according to data on labels. When I collected it in Apponaug Pond in 1938 it was exactly like the plants Robbins collected there in 1865.

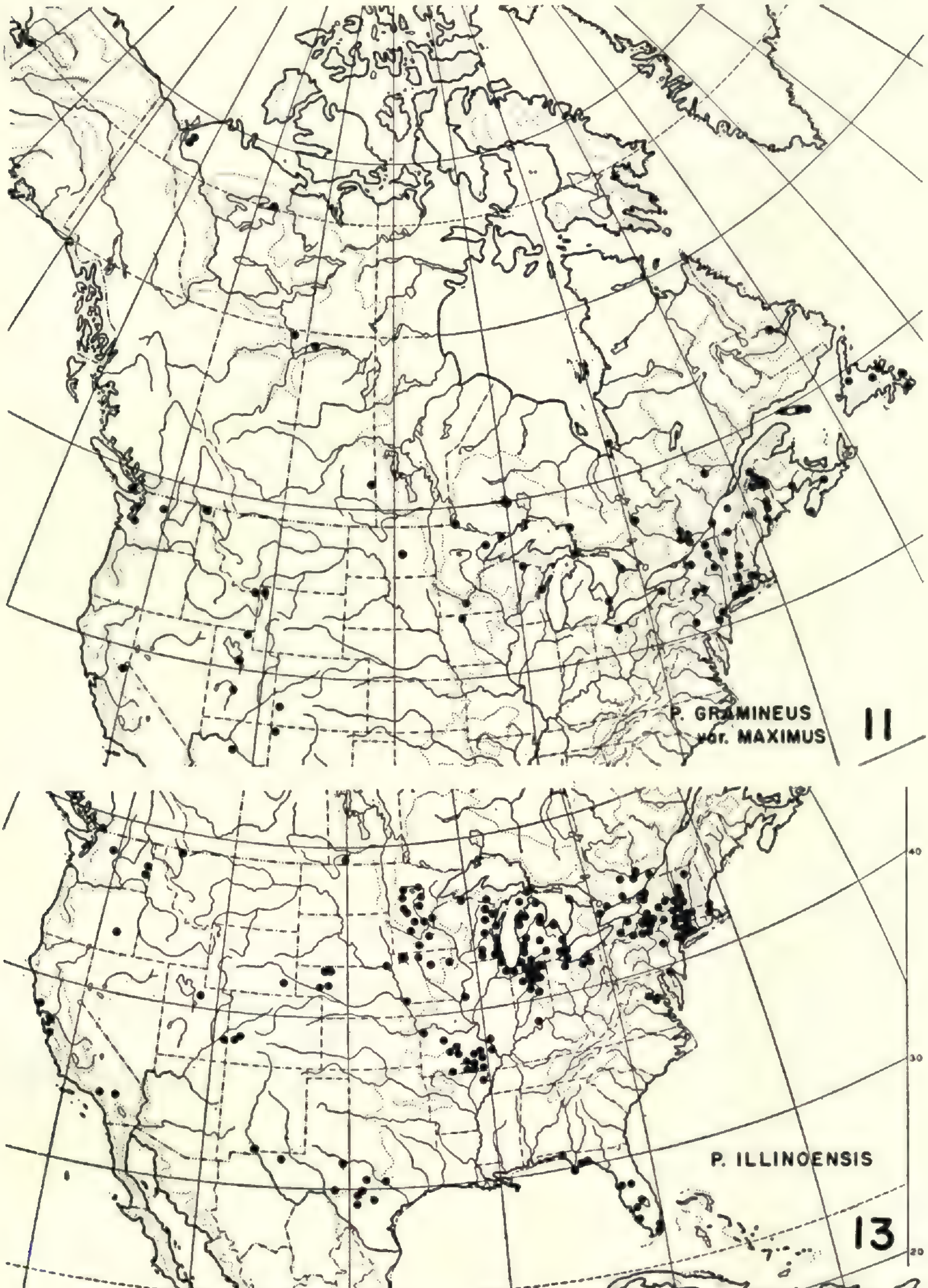
The variety *maximus* is perhaps the most variable one. It differs from the other variants of the species in the larger size of the submersed leaves, less branching of the stem, and usually longer internodes. While for most collections this variety seems to be genetic, for many the condition appears to be ecological. It is oftentimes very difficult to distinguish it from hybrids having *P. gramineus* for one of the parents. It can usually be distinguished from *P. gramineus* × *P. illinoensis*, which appears most like it, by the more flaccid stem and leaves of the variety.

Plants appearing like typical *P. gramineus* or var. *maximus*, except that the submersed leaves are oblanceolate or spatulate, with the apex rounded, mucronate, or cuspidate (often with many variations on the same plant) occur. These have been called *P. gramineus* var. *spathulaeformis*. The type material upon which this name is based is from the Mystic Lakes, Medford, Mass. and proves to be *P. gramineus* × *P. illinoensis*. Plants with submersed leaves somewhat similar but usually smaller and with floating leaves usually orbicular or very short-elliptic occur in Newfoundland, Quebec, New Brunswick, Vermont, New York, Ontario, Michigan, Minnesota and Iowa. While the usual stem-anatomy pattern is that of *P. gramineus*, occasionally O-cells are found in the endodermis, thus pointing toward a parent (or grandparent) with an endodermis of O-cells. The broad rounded apex of the submersed leaves and the nearly orbicular floating leaves point to an ancestor with broad rounded leaves. Some of these plants are *P. gramineus* × *P. perfoliatus*,

others are *P. gramineus* × *P. Richardsonii*, in both cases probably backcrossed with *P. gramineus*. At Moran, Mackinac Co., Michigan, in the shallow water at the northwest end of Brevort Lake, I found typical *P. gramineus* (*Ogden & Bolan 1680*) and obvious *P. gramineus* × *P. Richardsonii* (*Ogden & Bolan 1681*, with *Richardsonii*-like submersed leaves and *gramineus*-like floating leaves) and clearly intermediate between the two a plant with oblanceolate submersed leaves (*Ogden & Bolan 1681* in Gray Herbarium). See discussion of these hybrids on later pages. Not all oblanceolate-leaved plants are hybrids, however, for leaves of the typical variety or of the variety *maximus* which have been produced at the surface of the water may tend to form a transition to the floating type, which may narrow the lower half and produce a mucro at the apex; in such cases the lower leaves, if submersed, will have the normal shape. Then, too, submersed leaves often have a tendency for the edges of the lower part to curl under, giving the leaf a false oblanceolate shape which close examination will detect.

10. P. illinoensis Morong

Rhizome buff, spotted, streaked, or suffused with red, as thick as or thicker than the stem. Stem simple or branched, terete, but sometimes much flattened when pressed, (1–) 1.5–5 mm. in diameter; stele with the proto-type, trio-type, or oblong-type pattern with (1) 2 central bundles and 2 or more lateral bundles on each side; endodermis of strongly developed U-cells; interlacunar bundles strongly developed in the outer interlacunar circle, sometimes a few in the next to the outer circle; subepidermal bundles present or absent; pseudo-hypodermis absent or 1 cell thick. Submersed Leaves thin, elliptic or oblong-elliptic (sometimes ovate-elliptic) to lanceolate or linear (by the further reduction of the blade to the midrib), often somewhat arcuate; blades 5–20 cm. long, (.2–) 1.5–4 (–4.5) cm. wide, sessile or tapering (except when reduced to midrib) into petioles up to 4 cm. long; apices acute, usually somewhat mucronate; nerves (7–) 9–17 (–19); lacunae of 2–5 rows along midrib and larger nerves; margin with fugacious 1-celled translucent denticles. Floating Leaves (often absent) more or less coriaceous, transition to submersed leaves usually gradual; blades elliptic, ovate-elliptic, or oblong-elliptic, 4–13 (–19) cm. long, 2–6.5 cm. wide; apices obtuse, ending in a blunt mucro; bases cuneate or rounded; petioles 2–9 cm. long, shorter than the blade; nerves 13–29; lacunae of 2 or 3 rows of cells along midrib, some-



RANGES OF POTAMOGETON

times obscure. Stipules persistent, divergent and conspicuous, obtuse, those of the submersed leaves (1–) 2.5–8 cm. long, (.3–) .5–1.2 cm. wide at base, prominently 2-keeled, with 15–35 finer nerves; those of the floating leaves broader. Peduncles as thick as or thicker than the stem, 4–15 (–30) cm. long. Spikes in anthesis more or less compact, of 8–15 whorls of flowers; in fruit cylindric and crowded (2.5–) 3–6 (–7) cm. long, .8–1 cm. thick. Flowers sessile or on pedicels up to .5 mm. long; sepaloid connectives orbicular to oval (or reniform), blades (1.3–) 1.6–3 (–3.2) mm. wide, claws 1–1.5 mm. long; anthers oblong, .6–2 mm. long. Fruits obovate to orbicular or ovate (2.5–) 2.7–3.5 (–3.6) mm. long (excluding beak), (2.1–) 2.2–3 mm. wide; sides flat; keels prominent and acute, the dorsal strongly developed above and below, the laterals less strongly developed but often each with a projecting knob at the base; beak facial, short, erect or curved toward the back; exocarp gray-green to olive-green (rarely brownish); endocarp with keels low but prominent, or with dorsal keel thin and very weak, beak deltoid, very weak, about .5 mm. long, loop solid; apex of seed pointing at about the middle of the opposite side (or between middle and base). A highly variable species in which the extremes appear distinct, but transitional specimens, which are not the exception but the rule, indicate that they are a confluent series.

P. illinoensis Morong, Bot. Gaz. **5:** 50 (1880); Mem. Torr. Club **3:** no. 2: 27 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 80 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 20 (1909); Hagstr., Crit. Res. Pot. 198 (1916). *P. lucens* of Am. authors; not L., Sp. Pl. 126 (1753). *P. Zizii* of Am. authors, in part; not M. & K. in Röhling, Deutschl. Fl. **1:** 845 (1823); not Koch ex Roth, Enum. Plant. Germ. **1:** 531 (1827). *P. Proteus lucens* C. & S., Linnaea **2:** 197 (1827) . *P. Proteus Zizii* C. & S., Linnaea **2:** 201 (1827), in part. *P. lucens* var. *connecticutensis* Robbins in A. Gray, Man. ed. 5: 488 (1867); Morong, Mem. Torr. Club **3:** no. 2: 31 (1893). *P. angustifolius* var. *connecticutensis* Bennett, Journ. Bot. **39:** 199 (1901). *P. Zizii* var. *connecticutensis* Morong ex Bennett, Journ. Bot. **39:** 199 (1901); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 83 (1907). *P. lucens* var. *floridanus* Bennett in Graebn. in Engler, Pflanzenr. **4:** fam. 11: 79 & 161 (1907); Bennett, Journ. Bot. **45:** 374 (1907). *?P. Zizii* var. *porrectifolius* Bennett in Graebn. in Engler, Pflanzenr. **4:** fam. 11: 83 (1907). *?P. Zizii* var. *gracilis* Bennett in Graebn. Pflanzenr. l. c. (1907). *Spirillus lucens* Nieuwland, Am. Mid. Nat. **3:** 17 (1913), as to plant, not as to source of name. *Spirillus Zizii* Nieuwland, Am. Mid. Nat. **3:** 17 (1913), in part. *P. illinoensis* forma *rosulatus* Hagstr., Crit. Res. Pot. 199 (1916). *P. illinoensis* forma *homophyllus* Hagstr., Crit. Res. Pot. 199 (1916). × *P. pseudolucens* Hagstr., Crit. Res. Pot. 199 (1916).

? × *P. perplexus* Benn., Trans. & Proc. Bot. Soc. Edinburgh **29:** 53 (1924).

Lakes and streams, southwestern Quebec to southern British Columbia, south to Florida, Texas and California, MAP 13. Mex., Centr. Am., and W. I. Of the very numerous collections, the following are the most typical from the areas cited: QUEBEC: Gatineau R., Wakefield, *Macoun 62021*. VERMONT: Lake Dunmore, Salisbury, Aug. 11 and 31, 1896 and Sept. 2, 1899, *Ezra Brainerd;* Lake Champlain, Sept. 1, 1880, *C. E. Faxon;* Lake Hortonia, Aug. 15, 1896, *Ezra Brainerd;* Barton P., 1829, herb. *Robbins*. MASSACHUSETTS: Fresh P., Cambridge, many collectors; Wenham P., Essex Co., Sept. 21, 1867, *J. W. Robbins;* Leverett P., July 1874, *H. G. Jesup*. CONNECTICUT: Lake Saltonstall, E. Haven, 1845, *Robbins*, also 1850, *Robbins* (G, NY, type collection of *P. lucens* v. *connecticutensis*); Lake Kenosha, Danbury, *E. H. Eames 11351;* Housatonic R., Aug. 1867, *Robbins;* Twin Lakes, Salisbury, Litchfield Co., *Ogden & Bolan 1569*. NEW YORK: Rockland L., July 17, 1892, *Morong;* Lake Cayuga, Cayuga, Aug. 20, 1884, *Morong;* Duck L., Conquest, Cayuga Co., *Eames, Randolph & Wiegand 11175;* bayou back of Renwick Park, Cayuga L., Ithaca, Tompkins Co., *Hitchcock 11175a;* n. of R. R. bridge, Cayuga, Cayuga Co., Oct. 1886, *W. R. Dudley;* Lake Oneida, July 28, 1880, *Miss M. T. Hotchkiss;* Lake Cossayuna, *Dobbin 1112;* Muskalonge Bay, Jefferson Co., *Muenscher & Maguire 1701;* Ballston L., Saratoga Co., *Muenscher & Clausen 4232 & 4233;* Warner L., Albany Co., *Muenscher & Clausen 4238;* Little York L., Preble, Cortland Co., *R. N. Jones 7465;* Greens L., Greene Co., *Muenscher & Curtis 5427*. PENNSYLVANIA: Lehigh, 1876, *E. A. Rau* (ME, "Hanover, Ind." printed on the label). DELAWARE: Stanton, Sept. 4, 1896, *A. Commons*. VIRGINIA: Four Mile Run, Alexandria, June 29, 1903, *I. Tidestrom;* Dyke, Fairfax Co., *Metcalf & Sperry 1690*. NORTH CAROLINA: Orton L., Orton Plantation, 10 mi. n. of Southport, Brunswick Co., Sept. 8, 1941, *R. K. Godfrey* (G). FLORIDA: near the south New R. canal, beyond head of New R., *J. K. & G. K. Small 4437;* near the Miami canal, *J. K. & G. K. Small 4486;* between Cutler and Longview Camp, *Small & Carter 1007;* Royal Palm Park, Dade Co., *Moldenke 752;* near Eustis, Lake Co., Oklawaha R., *Nash 859 & 1750*, also *Curtiss 6692;* Caloosa R., *Simpson 386;* Everglades, Miami R., *Small & Carter 1118* (F, NY, US, type collection of *P. lucens* v. *floridanus*). ONTARIO: Golden L., Renfrew Co., July 28, 1899, *L. M. Umbach;* Pelee Island, Lake Erie, *Macoun 3023;* River Trent, *Macoun 2995;* Elziver, Hastings Co., *Macoun 2996;* Stokes Bay, Tobermory, Bruce Co., *Krotkov 7027*. MICHIGAN: Whitefish L., Mackinac Co., *Metcalf 2317;* n. w. of St. Ignace, Mackinac Co., *Pease & Ogden 24964;* Lake Orion, *Farwell 900;* Houghton L.,

Roscommon Co., June 1876, herb. *C. F. Wheeler;* Swan L., Allegan Co., *Wight 8;* Papaw L., Berrien Co., *C. K. Dodge 171;* Pine L., Clinton Co., *C. F. Wheeler 11 & 24.* Ohio: East Harbor, Ottawa Co., Aug. 10, 1898, *E. L. Moseley;* Bass L., Geauga Co., *Werner 954;* Sandusky Bay, Aug. 31, 1898, *A. J. Pieters.* Indiana: Old L., Whitley Co., *Deam 49428;* Tippecanoe L., *Scovell 53;* Lake Maxinkuckee, *Scovell 54,* also *Evermann 1079 & 1222,* also *Clark 6;* Lake Maxinkuckee, Culver, Marshall Co., Aug. 27, 1926, *J. R. Churchill;* Pine Station, Lake Co., Aug. 8, 1876, *E. J. Hill;* Clarke, *Umbach,* also *Lansing 1079;* Atwood L., n. w. of Wolcottville, Lagrange Co., *Deam 55350;* Lake Wawasee, Kosciusko Co., *Deam 56396 & 56401;* Lake James, w. of Pokagon State Park, Steuben Co., *Deam 56538 & 56539.* Wisconsin: Lake Wingra, Dane Co., June 20, 1892, *L. S. Cheney;* White L., near Weyauwega, Waupaca Co., *Hotchkiss & Martin 4432;* Pickerel L., Nashville Twp., Forest Co., *Hotchkiss & Koehler 4331;* Big Muskego L., Muskego Twp., Waukesha Co., *Hotchkiss & Koehler 4245;* Wind L., Norway Twp., Racine Co., *Hotchkiss & Koehler 4226 & 4227;* Pike L., Hartford Twp., Washington Co., *Hotchkiss & Koehler 4262;* Shawano L., Washington Twp., Shawano Co., *Hotchkiss & Koehler 4304;* Lake Noque Bay, Lake Twp., Marinette Co., *Hotchkiss & Koehler 4326.* Illinois: Mississippi River Bottoms near Oquawka, July 23, 1873, Aug. and Sept. 1881, *H. N. Patterson* (type material); Pittsburger L., Centerville, June 29, 1878, *H. Eggert;* Lake Villa, Sept. 28, 1887, *M. B. Waite.* Manitoba: Souris, July 7, 1883, *J. M. Macoun.* Minnesota: Elk L., Itaska Park, Clearwater Co., *Grant & Oosting 3184;* Evans L., Kandiyohi Co., *Metcalf 2377;* Green L., Kandiyohi Co., *Metcalf 2039, 2048 & 2045;* Lake Lizzie, Ottertail Co., *Metcalf 1563;* Rice L., Paynesville, *Metcalf 1427 & 1432;* Koronis L., Stearns Co., *Metcalf 1379, 1383 & 1391,* also *Kubichek 110, 114, 115 & 121;* Swan L., Nicollet Co., *Metcalf 8;* Martin L., Anoka Co., *Metcalf 1329;* Birch L., Sherburne Co., *Metcalf 1370;* Horseshoe L., Chisago Co., *Kubichek 71 & 72;* Prior L., Scott Co., *Oosting 2938;* Lake Ida, Douglas Co., *Uhler & Warren 858;* Lake Julia, Sherburne Co., *Keck & Stevens 280;* Borden L., Garrison Twp., Crow Wing Co., *Hotchkiss & Jones 4113;* Center City, Aug. 1892, *B. C. Taylor;* Two Inlet L., Becker Co., *Shunk & Manning 237.* Iowa: Armstrong's Grove, Emmet Co., July 21, 1882, *R. I. Cratty* (cotype collection of *P. illinoensis*); Fayette, July 1894, *B. Fink 191;* Fremont Co., Aug. 2, 1898, herb. *T. J. & M. F. L. Fitzpatrick;* Clear L., Cerro Gordo Co., July 11, 1896, *B. Shimek.* Missouri: Fish L., Sibley, Jackson Co., *Mackenzie 293;* Gasconade R., between Falcon and Nebo, Laclede Co., *Steyermark 13910;* Current R., n. of Buffalo Creek, e. of Bennett, Ripley Co., *Steyermark 14285;* Phillips Spring, s. e. of Van Buren, Carter Co., *Steyermark 21235;*

Marble Creek, s. of French Mills, St. Francois Purchase Unit, Clark Nat. Forest, Madison Co., *Steyermark 21087*. ARKANSAS: St. Francis R., Paragould, Greene Co., June 27, 1893, *H. Eggert.* SOUTH DAKOTA: water hole near Missouri R., Clay Co., *Over 4008*. NEBRASKA: Rat L., *Thomson 53;* Swan L., s. of Whitman, Grant Co., *Rydberg 1440;* Shafer L., Garden Co., *Uhler & Martin 1662;* Hackberry L., Cherry Co., *Thomson 145*, also *Sharp 11;* Dewey L., Cherry Co., *Tolstead 614*. TEXAS: Guadalupe R., Kerrville, Kerr Co., *E. J. Palmer 12217;* 16 mi. n. of Leakey, Real Co., *Cory 8502;* San Antonio, *Thurber 48;* Montell Creek, Uvalde, *Cory 9800;* McKittrick Canyon, Guadalupe Mts., Culberson Co., *Moore & Steyermark 3667* (not typical). WYOMING: Laramie R., *Elias Nelson 3386*. COLORADO: Tabequache Basin, *Payson 174;* Cerro Summit, region of Gunnison Watershed, *Baker 427*. UTAH: Twelve Mile Cañon, Wasatch Mts., *Tidestrom 517*. NEW MEXICO: San Augustine Ranch, Organ Mts., Dona Ana Co., July 10, 1909, *E. O. Wooton*. CALIFORNIA: Marine Hospital, San Francisco, June 27, 1892, *J. W. Blankinship;* Mission Dolores, *Bolander 274;* near Sebastopol, Sonoma Co., Aug. 1900, *M. S. Baker;* Mountain L., San Francisco, Aug. 22, 1920, *Alice Eastwood* (not typical). OREGON: creeks, western Oregon, 1880, *T. J. Howell;* in a warm spring, Harney Valley, June 10, 1885, *Thomas Howell* (F, mixed with *P. alpinus* v. *tenuifolius*, C, G, US, not mixed). WASHINGTON: Lake Chelan, Washington Forest Reserve, *Gorman 703;* Turnbull Slough, Spokane Co., *Sperry & Martin 731*. BRITISH COLUMBIA: Sumas L., Chilliwack Valley, *J. M. Macoun 26815* (perhaps a hybrid; type of × *P. perplexus* in C, isotypes in G, NY).

The highly complex species, *P. illinoensis*, has been variously treated by students of the genus. Morong[1] restricted the name to two collections of those known to him: Oquawka, Ill., collected by H. N. Patterson, and Armstrong's Grove, Iowa, collected by R. I. Cratty. Both plants are very robust and evidently grew in shallow, quiet, rich, muddy water. He complained that some botanists doubted the validity of *P. illinoensis* as a distinct species, but argued that it ". . . is evidently allied to *lucens* in habit, and with that species, *P. angustifolius*, *P. spathulaeformis* and *P. heterophyllus*, forms a very natural group, but it is clearly distinct from all of them in its vigorous growth, its abundant foliage, its ample floating and submerged leaves, and its large, strongly 3-keeled fruit."[2] Of these characters, the only one that can be considered of specific importance is that per-

[1] Thomas Morong, Mem. Torr. Club, 3: no. 2: 27 (1893).
[2] Thomas Morong, Mem. Torr. Club 3: no. 2: 28 (1893).

taining to the fruit, and examination shows that the fruits of the plants in this country called *P. lucens* or *P. angustifolius* are as strongly 3-keeled as those of *P. illinoensis*. Graebner's treatment of this group is quite artificial. He followed Morong's grouping rather closely but recognized numerous subspecies, varieties, subvarieties, and forms to account for the minor divergencies. The name *P. illinoensis* was, however, confined to the two original collections. Hagström evidently made a genuine attempt to understand the complex. Lack of sufficient material greatly handicapped him. He was misled by previous treatments into believing that *P. lucens* occurs in this country, but cited no specimens. Morong, who had realized that the plants he referred to *P. lucens* did not match any of the European forms of that species, treated them as var. *connecticutensis*. Hagström ignored this, except to question its being a variety of *P. lucens*, and does not even include it as a synonym. Some sterile specimens in North America resemble *P. lucens* of Europe but they lack the tendency for the lower leaves to have the blades reduced at the apex so that the midrib extends well beyond as a cusp. When mature fruits are obtained, the keels are seen to be prominent and acute (those of *P. lucens* are low and rounded) and the beak is more facial. Interestingly enough, specimens with mature fruit do not have the compact, bushy habit of *P. lucens* and would not be confused with that species.

Hagström considered *P. angustifolius* (*P. Zizii*) to be the hybrid *P. gramineus* × *lucens*, a belief held or suspected by many students of the genus. He cites specimens from North America but calls attention to the fact that ". . . many *Zizii*-like North American plants are not at all this hybrid, but of another origin, and great carefulness is necessary when considering these difficult forms."[1] If *P. lucens* does not occur in this country, the hybrid *P. gramineus* × *lucens* must be absent also. It may be suspected that the hybrid *P. gramineus* × *illinoensis* is not uncommon with us for it is known that each of these closely related species hybridizes with species of other subsections. Many intermediate forms occur, but it is usually difficult to determine which are the results of crossing and which are ecological variants of one or the other species.[2] The plants of the subsection *Lucentes*

[1] J. O. Hagström, Crit. Res. Pot. 216 (1916).

[2] See discussion under Hybridism.

fruit as freely as the average species of *Potamogeton*, and I think that nearly all of them must be considered to belong to one or the other of the two species.

The earliest specific name for the large-leaved plant is *P. illinoensis* Morong. This species has several variants, the recognition of which is made difficult in that ecological forms of one may simulate normal states of another. The *Lucentes* need to be studied cytologically and, until the hybrids having *P. illinoensis* as a parent are better understood, a grouping of the variants into varieties would be merely an artificial one. In order not to delay this treatment further, *P. illinoensis* is treated in the broad sense, including its many variations.

11. P. PRAELONGUS Wulfen

RHIZOME whitish, suffused or spotted with rusty red, as thick as the stem or often much thicker. STEM simple or branched, whitish or olive-green, often zigzag, 1.5–4 mm. in diameter; stele with the proto-type pattern; endodermis of U-cells; interlacunar and subepidermal bundles present; pseudo-hypodermis 1–3 cells thick. LEAVES all submersed, ovate-oblong, (5–) 10–20 (–36) cm. long, 1–3 cm. wide, 13–25 nerves, 3–7 of them more prominent than the others, cordate or rounded at base and clasping ⅓ or ½ the circumference of the stem; apex cucullate, splitting when pressed, or rounded; margin entire; lacunae of 2–4 rows of cells each side of the midrib. STIPULES white, nerves moderately strong, oblong to oblong-linear or ovate-lanceolate, rounded at apex, (3–) 5–10 cm. long, without keels, usually persistent and conspicuous. PEDUNCLES variable in thickness, clavate, (5–) 15–60 cm. long. SPIKES with 6–12 whorls, not crowded at anthesis, sometimes moniliform; in fruit 3–5 cm. long, 1.1–1.4 cm. thick. FLOWERS sessile or on pedicels up to .5 mm. long; sepaloid connectives greenish, blades orbicular or elliptical, (1.7–) 2–2.6 (–2.9) mm. wide, claws 1–2 mm. long; anthers 1–2 mm. long. FRUITS obovate, rounded on the back, cuneate at base, (4–) 4.3–5 mm. long (excluding beak), 3.2–4 mm. wide; beak prominent, short and thick; dorsal keel acute and strongly developed, especially upward; lateral keels rounded or none; exocarp dark green; endocarp with rounded lateral keels and a dorsal keel which is alate, thin and weak, beak linear, facial, about .8 mm. long, loop with a linear cavity; apex of seed pointing toward the basal end or slightly above. Plants characterized by large ovate-oblong leaves, cucullate at the tip, whitish stem, large conspicuous stipules, and with long peduncles bearing large fruits.

P. praelongus Wulf., Arch. Bot. Roem. **3:** 331 (1805); Benn., Journ. Bot. **19:** 241 (1881); Morong, Mem. Torr. Club **3:** no. 2: 32 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 96 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 22 (1909); Hagstr., Crit. Res. Pot. 250 (1916). *Spirillus praelongus* Nieuwl., Am. Midl. Nat. **3:** 17 (1913).

Deep, cold water, southern Labrador, Newfoundland, Gaspé Peninsula, Prince Edward Island, New England, and New Jersey, west to California, and north to Alberta, Mackenzie and the Aleutian Islands. Map 14. Eurasia. Reported from Mexico. The following, from a large series of specimens, are representative: Labrador: Trout P., Blanc Sablon R., Straits of Belle Isle (also on the Quebec side of the river), *Fernald & Long 27347.* Newfoundland: Cook Point, Pistolet Bay, *Fernald, Gilbert & Hotchkiss 27346;* Tilt Cove, northern shores of Notre Dame Bay, *Fernald, Wiegand & Darlington 4482;* Birchy Cove (Curling), Region of Humber Arm, Bay of Islands, *Fernald, Wiegand & Kittredge 2441;* Middle Birchy P., eastern drainage area of the Humber R. system, *Fernald & Wiegand 2444* (C, G, flaccid form); Morley's P., Humber Arm, Bay of Islands, *Fernald, Long & Fogg 1211;* Junction P., Whitbourne, Avalon Peninsula, *Fernald, Long & Dunbar 26223.* Quebec: Lac Pleureuse, Gaspé Co., *Fernald, Dodge & Smith 25423 & 25424;* West Branch of Mont Louis R., Gaspé Co., *Fernald, Dodge & Smith 25422;* Lac Sainte-Anne, Gaspé Co., *Victorin, Rolland & Jacques 33518;* New-Richmond, Bonaventure Co., *Victorin, Rolland & Jacques 33838;* Lac Porc-Épic, Saint-Fabien, Rimouski Co., *Rousseau 30004.* Prince Edward Island: Dundee, Kings Co., *Fernald, Long & St. John 6767;* French River, Queens Co., *Fernald, Long & St. John 6768.* New Brunswick: Woodstock, Aug. 1884, *Geo. U. Hay 4131.* Nova Scotia: Earltown Lakes, Aug. 10, 1883, *McKay 4129.* Maine: Houlton, Aroostook Co., 1881, *Furbish;* 5th Lake Musquacook, Piscataquis Co., *G. B. Rossbach 82;* St. John P., Somerset Co., *St. John & Nichols 2107;* Pushaw L., Orono, Penobscot Co., Aug. 1891, *Furbish;* Hammond P., Hampden, Penobscot Co., *Ogden & Steinmetz 1604;* Hermon P., Hermon, Penobscot Co., *Ogden, Babel & Kozicky 1880* (flaccid form); Pleasant P., Stetson, Penobscot Co., *E. C. & E. B. Ogden & F. H. Steinmetz 1882, Gray Exsic. no. 1105;* Androscoggin R., Livermore Falls, Androscoggin Co., 1894, *Furbish;* Torsey P., Kent's Hill, Readfield, Kennebec Co., 1892, *Furbish.* New Hampshire: Ladd P., Stewartstown, *Pease 14012;* Streeter's P., Lisbon, June 18, 1887, ex herb. *E. & C. E. Faxon;* Round P., Connecticut Lakes, *Kendall, Gouldsborough & Doolittle 17.* Vermont: Shelburne P., June 28, 1878, *Pringle;* Harvey's P., West Barnet, Sept. 7, 1885, *F. Blanchard;* Willoughby, Orleans Co., Aug. 31, 1904, *A. Lorenz.* Massachusetts: Chadwick's P., Essex Co.,

S. K. Harris 539; Pleasant L., Hamilton, Essex Co., *Fernald & Svenson 749;* Fresh P., Cambridge, Middlesex Co., *many collectors;* Harmon P., New Marlboro, Berkshire Co., June 29, 1912, *R. Hoffmann;* Stockbridge Bowl, Stockbridge, Berkshire Co., Aug. 9, 1914, *R. Hoffmann.* CONNECTICUT: Bantam L., Litchfield, Litchfield Co., July 25, 1883, *Morong;* Lake Saltonstall, Sept. 23, 1880, *E. & C. E. Faxon;* Twin Lakes, North Branford, New Haven Co., June 22, 1887, *E. B. Harger;* Twin Lakes, Salisbury, Litchfield Co., *Eames & Godfrey 8685.* NEW YORK: Southeast Bay, Saratoga L., Saratoga Co., *Muenscher & Lindsey 2819;* Dexter L., St. Lawrence Co., *Muenscher & Maguire 829;* Lake Placid, Essex Co., *Muenscher, Manning & Maguire 141;* Cayuga L., Tompkins Co., July 29, 1884, *Dudley;* Pierrepont P., inlet from Lake Ontario, Woodville, Jefferson Co., *House 10070;* Ballston L., Saratoga Co., *Muenscher & Clausen 4205.* NEW JERSEY: Swartswood L., Sussex Co., *Griscom & Mackenzie 10681.* ONTARIO: Lake Hannah, Nipigon R., July 21, 1884, *John Macoun;* Lake Scugog, *Wm. Scott 16451,* also *Cain 972;* Inner Long Point Bay, Lake Erie, *Cain 1050;* Almonte, July 6, 1898, *J. Fowler.* MICHIGAN: Isle Royale, *Cooper 312;* Lake Manganese, Copper Harbor, Keweenaw Co., *Hermann 8234;* Tahquamenon R., Luce Co., *Metcalf 2291;* Douglas L., Cheboygan Co., *Ehlers 533 & 1756,* also June, July 1924, *J. R. Swallen;* Fremont L., Newago Co., July 7, 1926, *Oosting;* Crystal L., Montcalm Co., *C. F. Wheeler 273;* Pine L., vicinity of Agr'l Coll., *C. F. Wheeler 10;* Haslet, *Yuncker 713;* Vicksburg, Kalamazoo Co., July 5, 1937, *F. W. Rapp;* Clear L., Jackson Co., *Hermann 6281.* OHIO: Put-in-Bay, July 16, 1898, *A. J. Pieters.* INDIANA: Bear L., Noble Co., *Deam 49394;* Wolf L., *Agnes Chase 1466;* Lake Maxinkuckee, *Scovell 45 & 66;* near Lake Maxinkuckee, *Scovell & Clark 1321.* WISCONSIN: Green Bay, 1892, *Schuette;* Twin Lakes, Marquette Co., *Uhler & Warren 1079;* Big Muskego L., Muskego Twp., Waukesha Co., *Hotchkiss & Koehler 4246;* Wind L., Norway Twp. Racine Co., *Hotchkiss & Koehler 4228;* Rice L., Nashville Twp., Forest Co., *Hotchkiss & Koehler 4340;* valley of the Wisconsin R., near Lac Vieux Desert, *L. S. Cheney 499;* Lauderdale, *Bebb 1009.* MINNESOTA: Burntside L., July 25, 1886, *L. H. Bailey;* Lake Itasca, Clearwater Co., *Grant 3029;* Swan L., *Hotchkiss & Jones 3928;* Center City, Chisago Co., July 1892, *B. C. Taylor;* Lake Chisago, *Metcalf 1229;* James L., Kandiyohi Co., *Metcalf 2387;* Geneva L., Freeborn Co., *Shunk & Manning 80;* German L., LeSueur Co., *Shunk & Manning 229;* Leaf L., Becker Co., *Shunk & Manning 368;* Christine L., Douglas Co., *Shunk & Manning 410;* Pelican L., Wright Co., *Linsdale & Keck 153,* also *Uhler & Warren 797½;* Child L., Cass Co., *Metcalf 2371;* Lake Johanna, Pope Co., *Keck & Stilwill 455.* IOWA: Clear L., Cerro Gordo Co., July 11, 1896, *B. Shimek.* NORTH

Dakota: Roland Twp., Turtle Mts., Bottineau Co., *Metcalf 522;* Pelican L., Turtle Mts., Bottineau Co., *Metcalf 546.* Nebraska: Hackberry L., Cherry Co., July 18, 1912, *Pool & Folsom;* Dewey L., near Valentine, *Tolstead 430;* Enders L., *Thomson 2.* Mackenzie: 2nd Eskimo L., 68° 10′ N., 132° 55′ W., Aug. 19, 1927, *A. E. & R. T. Porsild.* Alberta: Moose Lake district, Wood Buffalo Park, *Raup 1570 & 1571;* Murdock Creek district, Wood Buffalo Park, *Raup 1572.* Montana: Lower Two Medicine Lakes, *Maguire 485;* Lower St. Mary's L., *Maguire 486.* Idaho: Henry L., Fremont Co., *E. B. & L. B. Payson 2024;* Gray's L., *Sperry & Martin 696.* Wyoming: Swastika L., Medicine Bow Mts., Albany Co., *A. & R. A. Nelson 973,* also *R. J. Davis 378-W;* Heart L., Yellowstone Nat'l Park, *Clifford Richardson.* Colorado: Cottonwood L., *Shear 3804;* vicinity of Twin Lakes, July–Aug. 1902, *C. Juday;* Echo L., s. w. of Idaho Springs, Clear Creek Co., *Ehlers 7957.* Utah: Panguitch L., *M. E. Jones 6023,* Fish L., Fish Lake Forest, July 23, 1922, *S. B. Locke;* Posey L., 14 mi. n. of Escalante, Garfield Co., Sept. 3, 1936, *Geo. Piranian.* California: Webber L., Sierra Co., Aug. 1894, *Dudley;* Lassen's Peak, July 1879, *Mrs. R. M. Austin.* Oregon: Wallowa L., *Cusick 2484;* Klamath marsh, Klamath Indian Reservation, *Coville 1254.* Washington: Wiser L., Whatcom Co., *Muenscher 7647;* Lake Leland, Jefferson Co., *Otis 1767.* British Columbia: Langford L., Vancouver I., *John Macoun 4132a & 88257;* Beaver L., near Victoria, *John Macoun 88258 & 88259.* Alaska: Atka, Aleutian Islands, *Eyerdam 948 & 1122.*

P. praelongus is a beautiful species with large bright green oblong leaves, and it often has extremely long peduncles terminated by huge spikes with massive fruit. It can scarcely be mistaken for any other species. Bennett[1] quotes remarks from Morong to the effect that this species fruits very late (Nov. to Dec.). However, specimens in herbaria with fruit are mostly collected in July and August. Robinson and Fernald say, "Fruiting in June and July, withdrawing the stems to deep water to mature the fruit,"[2] and this seems to be the case. More June collections of this plant are desirable. An extremely flaccid form (forma *elegans* Tiselius) was collected in Newfoundland by Fernald and Wiegand (*Fern. & Wieg. 2444*); one much like it grows in Hermon P., Maine (*Ogden, Babel & Kozicky* 1880).

12. P. Richardsonii (Bennett) Rydberg

Rhizome whitish, yellowish or pinkish, not spotted; scales blackish, rounded at apex. Stem often branched, unspotted,

[1] Arthur Bennett, Journ. Bot. **19**: 241 (1881).
[2] Robinson & Fernald, Gray's Man. ed. **7**: 74 (1908).

1–2.5 mm. in diameter; stele with the trio-type pattern, the phloem on the inner face of the trio-bundle appearing as 2 patches; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudo-hypodermis 1 cell thick, at least partly so. LEAVES all submersed, coarse, mostly ovate-lanceolate, often ovate at the lower part of the stem and becoming narrowly lanceolate above, (1.5–) 3–10 cm. long, (.5–) 1–2 cm. wide, nerves (7–) 17–29 (–33), all rather prominent, 3–7 of them more prominent than the others, cordate at base and clasping ½ or ¾ the circumference of the stem; apex acutish but never sharp-pointed, sometimes rounded; margin with fugacious 1-celled translucent denticles, which are usually more or less appressed, lacunae of 2 or 3 rows of cells each side of the midrib. STIPULES whitish, coarsely nerved, ovate to lanceolate, obtuse when young, 1–2 cm. long, without keels, early disintegrating into whitish fibers. PEDUNCLES at base about same thickness as stem, often clavate, 1.5–25 cm. long. SPIKES with 6–12 whorls, not crowded at anthesis, sometimes moniliform; in fruit 1.5–4 cm. long, and about 1 cm. thick. FLOWERS sessile or on pedicels up to .5 (–1) mm. long; sepaloid connectives greenish, blades orbicular or elliptical, (1.3–) 1.4–2 (–2.3) mm. wide, claws usually 1–1.5 mm. long; anthers (.8–) 1.1–1.3 (–1.4) mm. long. FRUITS obovate, rounded on the back and at the base, sides plump or with a shallow depression, (2.5–) 2.7–3.2 (–3.5) mm. long (excluding beak), (2–) 2.3–2.6 (–3) mm. wide; beak prominent, up to 1 mm. long; keels rounded or none, rarely acutish; exocarp usually gray-green or olive-green; endocarp with rounded keels, beak linear, facial, about .8 mm. long, loop with a cavity, or at least a weak area; apex of seed pointing toward the basal end or slightly above. Plants characterized by numerous coarsely-nerved perfoliate submersed leaves, with stipules persistent as whitish fibers.

P. Richardsonii (Benn.) Rydb., Bull. Torr. Club **32:** 599 (1905). *P. perfoliatus* var. *lanceolatus* Robb. in Gray, Man. ed. 5: 488 (1867); not Blytt (1861). *P. perfoliatus* var. *Richardsonii* Benn., Journ. Bot. **27:** 25 (1889); Morong, Mem. Torr. Club **3:** no. 2: 33 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 95 (1907). *P. perfoliatus* L. sensu Taylor, N. Am. Fl. **17:** pt. 1: 22 (1909), in part; sensu Hultén, Fl. Alaska & Yukon 101 (1940). *P. perfoliatus* var. *gracilis* sensu Fernald in Porsild, RHODORA **41:** 176 (1939). *Spirillus perfoliatus* var. *Richardsonii* (Benn.) Nieuwl., Am. Mid. Nat. **3:** 17 (1913). *P. perfoliatus* ssp. *Richardsonii* Hultén, Fl. Alaska & Yukon 102 (1940).

Deep water of lakes and rivers, Labrador, Quebec, northern Maine, Vermont and western Massachusetts, west to Utah and California, north to British Columbia, Mackenzie, Alaska and the Aleutian Islands. MAP 15.

(*To be continued*)

THE SENECIO ON THE COASTAL DUNES OF TEXAS

V. L. Cory[1]

At various times my friend and co-worker, Mr. H. B. Parks, has told me about a different Senecio growing on the coastal islands of Texas and has sent me specimens from various places. His material from Flour Bluff near Corpus Christi, collected October 18, 1936, caused me to draft a preliminary description of the plant and, even now, the type specimen is designated as No. 27538, which is of that collection. This specimen is deposited at the Gray Herbarium. However, in November, 1940, it was my privilege to visit, in the pleasurable company of Mr. Parks, the area in which this plant grows and to collect the plant myself at Del Mar, Boca Chica, at the mouth of the Rio Grande, along Red Fish Bay in Willacy County, and on Padre Island in Kleberg County. Representative material of these collections have been sent to various herbaria. To me this plant is closely associated with my companion of this trip, and I take pleasure in naming it in his honor.

Senecio Riddellii T. & G., var. **Parksii,** new var. Plant perennial, suffruticose, glabrous, 1 meter high or less, and the spread frequently equalling the height; stems more or less woody, 1 cm. broad more or less at the base, diffusely branched; branches ascending-spreading, very leafy; leaves succulent, drying brown or black, up to 10 cm. long and 8 cm. broad, pinnately divided into 5–9 linear, elongate, entire divisions, which are acute and as much as 5 cm. long and 3.5 mm. broad; heads 12 mm. high and about as broad, radiate, in a compound corymb, each branch of the stem usually with 20 heads or more; branches of the inflorescence axillary; peduncles 2–4 cm. long, 0.5 mm. broad or less, ascending-spreading, subtended by linear-lanceolate or narrower bracts that are up to 5 mm. long, calyculate with subulate scales, and bearing solitary heads; involucres campanulate, 1 cm. high, calyculate with subulate scales, glabrous; involucral bracts 12–17, linear-lanceolate or broader, scarious-margined; ray-flowers about 8; ligules spatulate, about 9 mm. long and 3 mm. broad; disk-flowers about 35, the corolla-tube 5 mm. long, the throat and limb 4 mm. long; achenes 2 mm. long or slightly more; slender, subterete, hirtellous; pappus copious, white, slightly longer than the corolla of the disk flowers.

Senecio Riddellii T. & G., var **Parksii,** var. nov. Planta

[1] Acting Chief, Division of Botany, Texas Agr. Expt. Station, A. and M. College of Texas.

perennis, suffruticosa, glabra, ad 1 m. alta, saepius totidem lata; caulibus plus minusve lignescentibus, basi minusve 1 cm. crassis, valde ramosis; ramis adscendenti-patentibus valde foliosis; foliis carnosis, in sicco brunneis vel nigris, ad 10. cm. longis, 8 cm. latis, in lobos 5–9 lineares, elongatos, integros partitis, lobis acutis, ad 5 cm. longis, 3.5 cm. latis; capitulis 12 mm. longis totidemque latis, radiatis, in corymbo composito ordinatis, in ramulo quove ca. 20; inflorescentiae ramulis axillaribus; pedunculis 2–4 cm. longis, 0.4 mm. latis vel minoribus, flore singulo terminatis, patenti-adscendentibus, bracteis lineari-lanceolatis vel angustioribus ad 5 mm. longis, bracteis subulatis calyculantibus; involucris campanulatis, 1 cm. longis, bracteis subulatis calyculantibus, glabris; bracteis involucralibus 12–17, linearilanceolatis vel majoribus, margine scariosis; floribus radialibus ca. 8; ligulis spathulatis, ca. 9 mm. longis, 3 mm. latis; floribus centralibus ca. 35, tubo 5 mm. longo, fauce cum limbo 4 mm. longis; acheniis 2 mm. longis vel paulo majoribus, gracilibus, subteretibus, hirtulis; pappo copioso, albo corallam florum centralium parum excedente.[1]

The species and its variety are widely separated geographically and also in the elevation of their habitats. To my knowledge the two plants come closest together in the occurrence of the species at the base of Iron Mountain in Brewster County and of the variety on the coastal dunes in the vicinity of Corpus Christi, or 550 miles or more apart on a straight line. Roughly the elevations of these two localities are 4650 feet and 50 feet. One would suspect that neither one of these plants could grow in the habitat of the other. For the most part in Texas the species grows scatteringly in grass-lands of the High Plains and extends southward into the Trans-Pecos Area, where in recent years it has become wide-spread and has increased most markedly in abundance at elevations exceeding 4100 feet, as noted in driving down Limpia Canyon in the Davis Mountains recently, while the variety grows in extensive and frequently dense stands on dunes of the coastal islands and the adjacent mainland, in which places the grass-cover is deficient or lacking. On casual observation the variety suggests *S. longilobus*, and it does not suggest *S. Riddellii* due to their difference in habit of growth. The species has a plant consisting of a clump of several erect stems, except in the inflorescence not branched above the base,

[1] I wish to express grateful acknowledgment to Dr. Leon Croizart for valuable assistance given in the preparation of the latin description.

while the variety is a plant consisting of a single stem, diffusely branched throughout. The variety has succulent foliage, and the leaves and their divisions are larger than in the species. The plant dries green in the species and brown or black in the variety, and the growth above the base tends to become woody in the variety and remains herbaceous in the species. The two plants seem to merit some sort of separation botanically.

Both Dr. S. F. Blake and Dr. J. M. Greenman recognize this plant as *Senecio Riddellii*, and I am deeply indebted to them for their courteous assistance. Type specimen is designated as No. 27538, which was collected by H. B. Parks, October 18, 1936, at Flour Bluff, a place which no longer exists, for the dunes were razed to provide for the site of the U. S. Naval Training Station at Corpus Christi. The type specimen is deposited at the Gray Herbarium.

May we tell a story of this plant-collecting trip? The mouth of the Rio Grande is two miles below Boca Chica, or three miles below Del Mar. Mr. Parks and I drove on the hard-packed wet sand of the beach down to near the mouth of the river, and parked the car higher up in the edge of the dry sand while exploring the dunes for plants. Our vehicle was a new truck on its first trip. In backing out of the dry sand the car came to rest in the edge of the water with the right rear wheel lodged in the fork of a tree-trunk buried in the sand and it soon became obvious that we were helpless to move the truck either forward or backward. Soon it became dark and the tide was coming in, and we did not know how high it might rise; so we moved the load of plant specimens to a near-by dune and built a rousing bonfire from drift wood. We figured on saving the plant specimens at any rate. Then we sat in the car and enjoyed the bright moonlight on the waters of the Gulf of Mexico and wondered somewhat if the water would rise high enough to wash our car away. My wife, who had become alarmed at our failure to return to camp at Brownsville, twenty-six miles from Boca Chica, came out about midnight and sponsored a relief party which was successful; we took our supper at one o'clock in the morning at Brownsville and were thankful that at least one cafe there remained open all night. This story is in memory of our visit to the mouth of the Rio Grande.

Carex flexuosa in Minnesota.—The finding of *Carex flexuosa* Muhl. ex Willd. (= *C. debilis* Michx. var. *Rudgei* Bailey[1]) in Minnesota represents an extension of the known range according to published accounts and data available at the University of Minnesota Herbarium. This sedge was collected October 11, 1941, growing on fine sandy loam in an oak forest. It was found on a very gentle slope within 50 feet of a small swamp. *C. gracillima* Schwein., *C. scoparia* Schkuhr ex Willd., and *C. pennsylvanica* Lam. were found growing nearby. This collection of *C. flexuosa* was made about one-half mile south of Rice Lake in Section 29, T31N, R22W, in southern Anoka County, Minnesota, P. L. 170. The specimens gathered were examined and my identification was sustained by Doctors C. O. Rosendahl, F. K. Butters, and John W. Moore, of the University of Minnesota.

On June 4, 1942, Dr. Moore, to whom I am also indebted for valuable help in exploring the available data on this sedge, accompanied me on a special trip to the locality for the purpose of making an additional check on the species. We found *C. flexuosa* with its perigynia practically full-grown and a set of identifiable specimens was obtained. Specimens of the associated species *C. gracillima*, *C. scoparia*, *C. pennsylvanica*, and *C. brunnescens* (Pers.) Poir. were also collected.

The culms of the *C. flexuosa* plants gathered in the fall were about one meter tall, while those collected in June were about half this height. Both collections (P. L. 170 and P. L. 205), as well as the other species mentioned, have been deposited in the University of Minnesota Herbarium.

The nearest previous report for *C. flexuosa* was in Wisconsin.[2] A closely related species, *C. debilis* Michx. var. *pubera* A. Gray (= *C. allegheniensis* Mackenzie), has been erroneously reported for Minnesota.[3] At the suggestion of Dr. M. L. Fernald the specimen in the United States National Herbarium was checked by Dr. Frederick J. Hermann and found to be *C. assiniboinensis* W. Boott, a common resident of Minnesota.—Paul C. Lemon, University of Minnesota.

[1] Hermann, Frederick J. The genus Carex in Indiana. In C. C. Deam, Flora of Indiana, page 255. 1940.

———. The genus Carex in Michigan. American Midland Naturalist, **25**: 47–48. 1941.

[2] Fernald, M. L. Critical notes on Carex. Rhodora, **44**: 310. 1942

[3] Minnesota Botanical Studies, **1**: 528. 1896.

Scirpus Peckii in Canada.—The handsome and very distinct *Scirpus Peckii* Britton has heretofore been known only from a limited area, from Somerset County, Maine, to Franklin and Oswego Counties, New York, thence south, very locally, to southwestern New Hampshire, western Massachusetts, northwestern Connecticut, and the Catskill region of southeastern New York. Since at Sutton, Vermont, and at Loon Lake, Franklin County, New York, it is within 30 miles of the Canadian border, it has been natural to suppose that it might get into southwestern Quebec and extreme eastern Ontario. This expectation is partly fulfilled, for I find in the covers of *S. cyperinus* in the Gray Herbarium a very characteristic sheet of flowering *S. Peckii* collected July 23, 1926, at Bellerive, Beauharnois County, Quebec, by Frère Vincent and sent out by Fr. Adrien as no. 1–235. This station is about 50 miles north of Loon Lake.—M. L. Fernald.

Volume 45, no. 531, including pages 57–112 and plates 746–748, was issued 18 March, 1943.

MAY 7 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. May, 1943. No. 533.

CONTENTS:

Probable Relationship of Phaseolus polystachios to other Species. *H. A. Allard.* 169

The Broad-leaved Species of Potamogeton of North America north of Mexico (concluded). *E. C. Ogden.* 171

Caltha natans in Canada. *Harold A. Senn.* 214

Polygonum puritanorum in Maine. *Arthur Stanley Pease.* 215

Double-flowered Form of Gillenia trifoliata. *J. W. Adams.* 215

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to
M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY
Specialists in Scientific and Technical Publications
EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,
Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

H

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. May, 1943. No. 533.

THE PROBABLE RELATIONSHIP OF PHASEOLUS POLYSTACHIOS TO OTHER SPECIES

H. A. Allard

The only wild native bean in the eastern United States is the so-called Kidney Bean, *Phaseolus polystachios* (L.) BSP. This bean inhabits the Coastal Plain and the Piedmont areas, but is not found in high-mountain areas. It is a rather rare species of rich deciduous woods, where its perennial root can find winter protection under thick blankets of ground-debris and decaying leafage.

While the name "Kidney Bean" would suggest that it belongs to the species-assemblage represented by *P. vulgaris* L., there is reason to believe that its affinities may be nearer the assemblage of the Scarlet Runner beans represented by the species *P. coccineus* L. This conclusion is based upon the following behaviors.

The cotyledons of the *P. coccineus* assemblage and also of *P. polystachios* are hypogean, remaining buried in the soil, as in the case of *Pisum*. So far as known no members of the species *P. vulgaris* have this habit, the cotyledons always being carried above the soil at germination.

With respect to their length-of-day responses the varieties of *P. coccineus* tested by the writer and by other workers, have shown strong tendencies to flower most freely when experiencing long days. These varieties have either failed to flower or flowering has been greatly reduced when given daily photoperiods of 10 hours. If flowers developed, these were usually sterile or fruited very late in the season.

It may be stated that the Wild Bean, *P. polystachios*, becomes a dwarf, bushy, completely flowerless plant when given 10 hours of light. The writer's studies[1] have shown that it is an *intermediate* plant in its length-of-day behavior since flowering occurs only within a definite range of lengths of day. At certain lower limits flowering ceases because the days are too short, and at certain upper limits flowering ceases or is less profuse because the days are too long. *P. polystachios* is definitely not a short-day type and flowering is favored by long days which do not exceed certain limits. There are, on the other hand, few if any of the varieties of the *P. vulgaris* assemblage which show long-day tendencies or find lengths of day of 10 or 12 hours unfavorable to flowering.

In response to short photoperiods the roots of varieties of *P. coccineus* have usually shown strong tuberization and *P. polystachyios* has shown similar tendencies, both in the field and when long-day conditions favorable to flowering have been denied the plants.[2]

Both *P. polystachios* and *P. coccineus* show a greater degree of hardiness than members of the *P. vulgaris* assemblage. In England the Scarlet Runner beans sometimes overwinter by means of their tuberous roots, and for the same reason, the Wild Bean of eastern North America has become a perennial species.

These similarities of behaviors and responses that characterize the Wild Bean and the Scarlet Runner assemblage, more especially the hypogean behavior of the cotyledons, would indicate the former is more closely allied with the *P. coccineus* assemblage than to the kidney beans, *P. vulgaris*.

Washington, D. C.

[1] **Complete or Partial Inhibition of Flowering in Certain Plants when Days are too Short or too Long. H. A. Allard, Jour. Agr. Res.. 57 (10), 1938.**

[2] **Further studies in Photoperiodism, the response of the plant to relative length of day and night. W. W. Garner and H. A. Allard, Jour. Agr. Res. 23, 1923. Effect of length of day on flowering and growth. M. A. H. Tincker. Nature, Sept. 6, 1924, p. 350. Further observations on the responses of various species of plants to length of day. H. A. Allard and W. W. Garner. U. S. Dept. of Agr. Tech. Bull. 727, 1940.**

THE BROAD-LEAVED SPECIES OF POTAMOGETON OF NORTH AMERICA NORTH OF MEXICO

E. C. Ogden

(*Continued from page 163*)

The following, selected from a very large series of specimens, are representative: Labrador: Grand Falls of Hamilton R., *Doutt 3323.* Quebec: Lake Mistassini, *J. M. Macoun 3055;* Lac au Saumon, Matane Co., *Svenson & Fassett 3045;* Roberval, July 16, 1892, *Kennedy;* Lac William, near St. Ferdinand, *Louis-Marie, Laporte & Dudemaine 501;* Odanak, Yamaska Co., *Adrien 1806;* Longueuil, Chambly Co., *Victorin 18462,* also *Rolland 43354, 43355, 43356 & 43481;* Isle-aux-Noix, Richelieu R., *Victorin 8179.* Maine: Beau Lac, valley of St. Francis R., Aug. 14, 1902, *Eggleston & Fernald;* Fish River Lake, Aroostook Co., *Ogden 1717;* Round P., Aroostook Co., *Fellows 2007;* Cross L., Aroostook Co., *Fellows 4887.* Vermont: Lake Champlain, Orwell, Addison Co., *Cushman 6009;* Big Otter Creek, Ferrisburgh, Aug. 12, 1887, *Morong;* Ferrisburg, Aug. 16, 1896, *Eggleston;* Swanton, Franklin Co., *Blewitt 2137;* mouth of Winooski R., Burlington, Chittenden Co., Aug. 30, 1903, *N. F. Flynn,* also *Blake 2308;* Rescue L., Ludlow, Windsor Co., July 12, 1906, *Burnham.* Massachusetts: Pontoosuc L., Lanesboro, Berkshire Co., Sept. 9, 1915, *J. R. Churchill;* Mill R., New Marlboro, Berkshire Co., July 24, 1912, *R. Hoffmann.* New York: Muskalonge Bay, Lake Ontario, Jefferson Co., *Muenscher & Maguire 1782;* Salmon R., Selkirk, Oswego Co., *Fernald, Wiegand & Eames 14087;* Rapids above Niagara Falls, Aug. 21, 1886, *Morong;* Tioughnioga R., Cortland, Cortland Co., *E. L. Palmer 50;* Silver L., Perry, Wyoming Co., *Burkholder & Muenscher 16424;* Myers Point, Lansing, Tompkins Co., *Jones & Hoffmann 7467;* Cayuga L., July 15, 1879, and Aug. 28, 1884, *Dudley,* also Aug. 15, 1893, *Hermann von Schrenk,* also *Muenscher & Bechtel 459;* Bemus Point, Lake Chautauqua, Aug. 8, 1896, *J. R. Churchill;* Shushan, *Dobbin 1072 & 1327.* Pennsylvania: Brandywine Creek, Chester Co., no date, ex Herb. *Wm. M. Canby* (F, on a sheet with *P. perfoliatus* var. *bupleuroides;* perhaps the label refers only to *P. perf.* v. *bup.*). Ontario: Spawning L., Temagami Forest Reserve, *Cain 1051;* Lake Nipissing, *Chitty 306;* Agawa R., Lake Superior, *Pease 17983;* Lake Hannah, Nipigon R., July 21, 1884, *John Macoun;* Mississippi R., Galetta, Carleton Co., *Ogden & Bolan 1631;* Hay Bay, Tobermory, Bruce Co., *Krotkov 7041;* Golden L., Renfrew Co., *Macoun 22176.* Michigan: Ontonagon R., 1862, *J. W. Robbins;* Sault Ste. Marie, Aug. 6, 1881, *E. J. Hill,* also Aug. 25, 1882, *Morong;* Lake George, Homestead, Sugar Island, Chippewa Co., *Hermann 7153 & 7224;* Douglas L., Cheboygan Co., *Gates 258;* Lake Charlevoix,

Ironton, Charlevoix Co., *Ogden & Bolan 1678;* Thread P., Flint, Aug. 11, 1909, *Sherff;* Detroit R., *Gillman 65;* Black L., Ottawa Co., July 14, 1926, *Oosting.* Ohio: Sandusky Bay, Sept. 2, 1898, *E. L. Mosely;* Painesville, Aug. 21, 1887, herb. *W. C. Werner,* also *Biltmore Herbarium 688.* Indiana: Wolf L., Whiting, Lake Co., *Deam 55274A;* Hamilton L., Hamilton, Steuben Co., *Deam 56686;* Long L., Wolcottville, Lagrange Co., Aug. 20, 1930, *Johnson & Myers;* Culver Bay, *Scovell & Clark 1057;* Lake Maxinkuckee, *Scovell 27a,* also *Evermann 1057.* Wisconsin: University Bay, Lake Mendota, Aug. 19, 1912, *R. H. Denniston;* KaKagan R., Ashland Co., *L. S. Cheney 4919;* Port Wing, Bayfield Co., *Fassett 7535;* Oshkosh, 1877, *W. A. Kellerman;* State House, Trout Lake, Vilas Co., *Fassett 9061;* Green Bay, July 28, 1891, *Schuette.* Illinois: Calumet L., Chicago, *Chase 1421;* Lake Michigan, Chicago, Aug. 1860, *Dr. Scammon.* Manitoba: Brandon, *Macoun 16459.* Minnesota: Knife R., Lake Co., *Pease & Bean 26389;* Lake Itasca, Clearwater Co., *Grant & Oosting 3206;* Lake Augusta, Arno Twp., Cottonwood Co., *Hotchkiss & Jones 3976;* Wheeler L., Kandiyohi Co., *Metcalf 2124;* Center City, July 1892, *B. C. Taylor;* Swan L., Nicollet Co., July 1892, *C. A. Ballard,* also *Metcalf 9;* Chisago L., *Metcalf 1145 & 1176;* Rice L., Aitkin Co., *Metcalf 1463;* Lake Koronis, Stearns Co., *Metcalf 1390,* also *Kubichek 109;* Glacier L., Murray Co., *Metcalf 1839;* Linwood L., Anoka Co., *Kubichek 17;* German L., Le Sueur Co., *Shunk & Manning 220;* Mille Lacs L., Mille Lacs Co., *Keck & Stevens 323;* Lake Stewart, Otter Tail Co., *Oosting 302;* Lake Minnetonka, Navarre, *Oosting 2971.* Iowa: Clear L., Cerro Gordo Co., July 11, 1896, *B. Shimek;* Spirit L., Dickinson Co., July 31, 1896, *B. Shimek;* L. Okoboji, July 1888, *A. S. H.;* Estherville, July 1881, *R. I. Cratty.* North Dakota: Fish L., Bottineau, July 25, 1896, *M. A. Brannon;* St. Mary's L., Valley City, *Mabbott 251 & 252;* Leeds, Benson Co., July 29, 1899, July 24, 1900, July 22, 1906, July 31, 1907 & July 16, 1913, *Lunell;* Pelican L., Turtle Mts., Bottineau Co., *Metcalf 547;* Rush L., Cavalier Co., *Mabbot 500;* L. Wamtah, Foster Co., *Mabbot 350;* Jim L., Pingree, *Mabbot 317.* South Dakota: Lake Hendricks, June 20, 1891, *T. A. Williams;* Lake Campbell, July 4, 1893, *T. A. Williams;* Pickerel L., Day Co., *Over 14460 & 17134;* Clear L., Marshall Co., *Over 17137;* Clear L., Deuel Co., *Over 3366;* Big Stone L., Aug. 26, 1892 & Aug. 10, 1895, *T. A. Williams* (G, NY, S, narrow-leaved form); Big Stone L., Roberts Co., *Over 14464* (US, narrow-leaved form); Big Stone L., Grant Co., *Over 3367* (US, semi-narrow-leaved form); Sand L., *Griffiths 6* (F, G, semi-narrow-leaved form). Nebraska: Dewey L. near Valentine, *Tolstead 429 & 473;* 3 miles n. w. of Whitman, Grant Co., *Rydberg 1792;* Enders L., *Thomson 5;* Crescent L., *Thomson 299;* Shafer L., Garden Co., *Uhler & Martin 1659;* Lake Manawa,

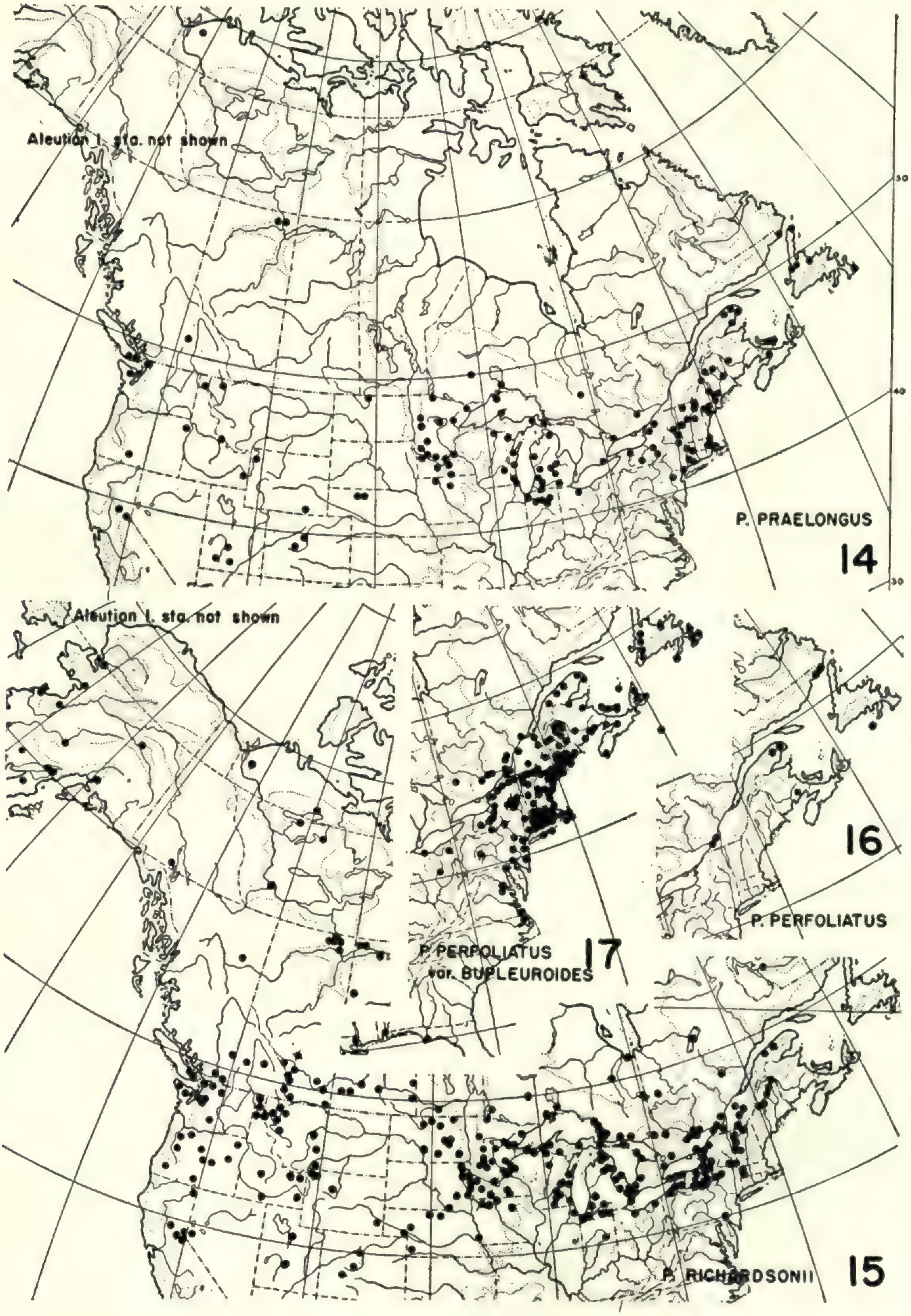
Omaha, *Amy C. Lawton 53* (F, semi-narrow-leaved form). MACKENZIE: Setidge L., Aug. 21, 1927, *A. E. & R. T. Porsild 3098;* Conquerors Bay, Aug. 15, 1928, *A. E. & R. T. Porsild;* Big Point, Aug. 24, 1928, *A. E. & R. T. Porsild.* SASKATCHEWAN: Yorkton, *Macoun & Herriot 76872;* Eagle L., *Macoun & Herriot 86871;* Methye L., *J. M. Macoun 4368;* near mouth of McFarlane R., Lake Athabasca, *Francis Harper 98;* Cornwall Bay, Lake Athabasca, *Raup 6617.* ALBERTA: Bow River Valley, *Stewardson Brown 694;* near Banff, *Macoun 4383;* Vermilion Lakes, Banff, *John Macoun 4380,* also *Malte & Watson 960,* also *McCalla 2370;* near Chipewyan, n. shore of Lake Athabasca, *Laing 147;* also *Raup & Abbe 4666.* MONTANA: Missoula Valley near Frenchtown, *S. Watson 397;* Flathead L., Polson, Flathead Lake Co., *Muenscher 10218;* Flat Top L., *Maguire 488;* Lower Two Medicine Lakes, *Maguire 495;* Swift Current Ridge L. (Bath Tub), *Maguire 490;* Trout L., Glacier National Park, *Maguire & Piranian 5440;* Midvale, *Umbach 433;* Big Fork, *MacDougal 805.* IDAHO: Lake Pend Oreille near Hope, *Sandberg, MacDougal & Heller 956;* Clarks Fork Valley below Weeksville, *Leiberg 1574;* Blackfoot R., Trail Ranger Station, Bannock Co., *Eggleston 9974;* Henry L., Fremont Co., *E. B. & L. B. Payson 2023;* Mud L., *Sperry & Martin 671;* Snake R., St. Anthony, *Merrill & Wilcox 863;* Portneuf R., McCammon, Bannoch Co., *Ray J. Davis 328–37;* Alturus L., *Evermann 492.* WYOMING: Goose Creek L., *Aven Nelson 2276;* Laramie R., *Elias Nelson 87 & 3362;* Lewis L., Yellowstone region, 1878, *C. Richardson;* N. Yellowstone L., *Tweedy 413.* COLORADO: vicinity of Twin Lakes, July–Aug. 1902, *C. Juday;* Tomichi R., Parlin, Gunnison Co., Aug. 20, 1901, *Benjamin H. Smith;* Kremmling, Grand Co., *Beetle 1462.* UTAH: Lehi, Aug. 1883, *M. E. Jones;* Fish L., *M. E. Jones 5788,* also *Rydberg & Carleton 7522.* NEVADA: Truckee R., *Sereno Watson 1135.* CALIFORNIA: Pit R., at Lookout, Modoc Co., Aug. 24, 1899, *M. S. Baker;* Webber L., Sierra Co., Aug. 1894, *Dudley;* Big Meadows, Plumas Co., *Mrs. R. M. Austin 575;* Feather R., *Mrs. R. M. Austin 1177;* Truckee R., alt. 4000 ft., *W. W. Bailey 1135.* OREGON: Des Chutes R., Lupine, Crook Co., *Peck 9619;* Ten-Mile L., near Lakeside, Coos Co., *Peck 9009;* Willamette R., Salem, *Hall 489 & 490;* Willamette R., June 1890, *Drake & Dickson,* also *Henderson 1009;* Strawberry L., Blue Mts., *Cusick 3620;* U. S. R. S. Main Canal, Klamath Falls, Klamath Co., *Applegate 3416;* Laidlaw, Crook Co., *Kirk & Whited 3141.* WASHINGTON: Lake Washington, Mercer Island, King Co., *J. W. Thompson 7594;* Lake Whatcom, Whatcom Co., *Muenscher 7653;* Seattle, June 26, 1889, *E. C. Smith 757,* also Aug. 1892, *C. V. Piper;* Quiniault, *Conard 318;* Prosser, Yakima Co., *Cotton 809;* Stevenson's Ranch, Lake Chelan, *Gorman 677;* Lake Sammamish, King Co., *Otis 1678;* also Aug.

30, 1936, *G. N. Jones.* British Columbia: Sicamous, *John Macoun 4127;* Sumas L., Chilliwack Valley, *J. M. Macoun 26817;* Cowichan L., Vancouver Island, *J. T. Howell 7679;* Shuswap L., *J. M. Macoun 3049;* Howser L., *Shaw 771 & 777;* Kamloops, *John Macoun 3048.* Yukon: Lewis R., Lat. 60°, Sept. 6, 1887, *Dawson 3046.* Alaska: Unalaklet, *A. E. & R. T. Porsild 1102;* Votlik, June 10–14, 1926, *A. E. & R. T. Porsild;* Pastolik, July 16–20, 1926, *A. E. & R. T. Porsild;* Holy Cross, July 5, 1926, *A. E. & R. T. Porsild;* False Pass, Unimak Island, Aleutian Islands, *Eyerdam 2156;* Fairbanks, *L. J. Palmer 1862;* Ankow R., *Piper 4430;* Matanuska, *J. P. Anderson 838 & 1522;* Pyramid Creek, Unalaska, *Jepson 238;* Selawik L., *L. J. Palmer 638* (US, mixed with *P. gramineus* var. *maximus*); Chuletna R., Lake Iliamna, *Gorman 233;* Naknek L., Point no. 795, Katmai Region, Alaska Pen., July 22, 1919, *A. E. Miller;* Kotlik, Yukon R. delta, *A. E. & R. T. Porsild 847.*

P. Richardsonii is closely related to *P. perfoliatus* and is considered by many to be merely a variety or state of that species. Often, on vegetative characters alone, the two species are difficult to distinguish, but with fruiting specimens there is never any question. The larger fruit, borne on clavate peduncles, and always with a cavity in the endocarp loop, is quite distinctive from that of *P. perfoliatus.* In the western part of its range, this plant exhibits the characteristic ovate-lanceolate leaves with the strong white stipule-fibers, and only in the region east of New York state do its leaves and stipules approach those of *P. perfoliatus.* As intermediate specimens are nearly always sterile and scarcely found except where the ranges of *P. Richardsonii* and *P. perfoliatus* var. *bupleuroides* overlap, it is reasonable to suppose that they are hybrids of these two closely related plants.

In many respects *P. Richardsonii* is intermediate between *P. praelongus* and *P. perfoliatus* and Hagström suggested that it "has arisen by cooperation between these two species."[1] It is however a fertile species (for a *Potamogeton*) and with its greatest development falling outside the range of *P. perfoliatus* it certainly cannot be considered a recent hybrid. The anatomy of its stem is exactly that of *P. perfoliatus* and strikingly different from that of *P. praelongus.* It would seem that if *P. praelongus* were involved in its origin it would retain some of the fundamental anatomical characteristics of that species, especially the

[1] J. O. Hagström, Crit. Res. Pot. 254 (1916).



RANGES OF POTAMOGETON

cortical bundles and a tendency to the prototypic stele. It would seem more logical to suppose that *P. praelongus* evolved from a *perfoliatus*-like ancestor, with *P. Richardsonii* as an intermediate step, except that *P. Richardsonii* is confined to North America (reported from Scotland[1]), while both *P. perfoliatus* and *P. praelongus* have a much wider distribution. Also such a postulate would involve the development of a proto-type stelar pattern from a trio-type pattern. The fossil record is of little or no help here, for both *P. perfoliatus* and *P. praelongus* appear for the first time in the Amber flora (Upper Eocene or Lower Oligocene) of Denmark,[2] and *P. Richardsonii* is not distinguished from *P. perfoliatus* in fossil literature. In America, members of the perfoliate-leaved species are reported only from the Pleistocene, near Ottawa, Canada.[3]

A narrow-leaved form of *P. Richardsonii* is found in Big Stone Lake, between northern South Dakota and Minnesota. It was collected there by T. A. Williams in 1892 and in 1895 and by W. H. Over in 1922 (no. 14464). Another collection from the same lake (*Over* 3367) and collections from Sand Lake, South Dakota (*Griffiths* 6) and Lake Manawa, near Omaha, Nebraska (*Lawton* 53) appear to be nearly the same thing, and several other collections approach it. This form might be considered a variety were it not that typical *P. Richardsonii* frequently produces narrow-leaved branches, especially in deep or moving water.

13. P. perfoliatus Linnaeus

Rhizome whitish or pinkish, not spotted. Stem terete, .4–2 mm. in diameter, often much branched; stele with the trio-type pattern, the phloem on the inner face of the trio-bundle usually appearing as 2 patches; endodermis of O-cells; interlacunar and subepidermal bundles absent; pseudo-hypodermis 1 cell thick, at least partly so. Leaves all submersed, delicate, orbicular to ovate-lanceolate, usually ovate, 1–6 (–7) cm. long, .5–3 cm. wide, nerves 7–21, not strongly developed, only 1–7 of them prominent, cordate at base and clasping about ¾ the circumference of the stem; apex rounded or at least broadly obtuse; margin with fugacious 1-celled translucent denticles which are usually divergent, lacunae of 1–3 rows of cells each side of the midrib.

[1] Arthur Bennett, Journ. Bot. **19**: 241 (1881).
[2] N. Hartz, Danmarks geologiske Untersogelse, **2**: no. 20: 121 (1909).
[3] J. W. Dawson, Can. Nat. n. ser., **3**: 72 (1868).

STIPULES delicate, membranous, translucent, often appressed to the stem and seemingly a part of it, fugacious, ovate-oblong, rounded at apex, .4–2 cm. long, without keels. PEDUNCLES about same thickness as stem, 1–9 cm. long. SPIKES with 2–8 whorls, not crowded at anthesis, sometimes moniliform; in fruit 1–2 cm. long, and about .8 cm. thick. FLOWERS sessile or on short pedicels up to .5 mm. long; sepaloid connective greenish, blades orbicular or elliptical, (1.2–) 1.4–1.9 (–2.3) mm. wide, claws .7–1.3 mm. long; anthers (.7–) .9–1.2 (–1.3) mm. long. FRUITS obovate, rounded on the back and at base, sides plump when mature, (2.3–) 2.5–2.7 (–3) mm. long (excluding beak), (1.7–) 2–2.1 (–2.3) mm. wide; beak usually prominent, up to .7 mm. long; keels rounded or none; exocarp usually gray-green or olive-green; endocarp with rounded keels, beak linear, facial, about .5 mm. long, loop solid; apex of seed pointing toward the basal end. Plants characterized by numerous, ovate, perfoliate, submersed leaves, with delicate weakly-nerved fugacious stipules.

Two varieties differing only in size but strongly marked as to their extreme variation:

Stem 1–2 mm. in diameter; leaves 1.5–3 cm. wide, 11–21 nerves, 5–7 of them prominent.....13a. var. *typicus*.
Stem .4–1.5 mm. in diameter; leaves .5–2 cm. wide, 7–17 nerves, 1–5 of them prominent.....13b. var. *bupleuroides*.

13a. P. PERFOLIATUS L. var. **typicus**

P. perfoliatus L., Sp. Pl. **1:** 126 (1753); Morong, Mem. Torr. Club **3:** no. 2: 33 (1893), in small part; Graebn. in Engler, Pflanzenr. **4:** fam. 11: 92 (1907), in part; Taylor, N. Am. Fl. **17:** pt. 1: 22 (1909), in small part; Hagstr., Crit. Res. Pot. 254 (1916). *P. perfoliatus* var. *gracilis* Am. auth., in part; perhaps C. & S., Linnaea **2:** 190 (1827). *Spirillus perfoliatus* Nieuwl., Am. Mid. Nat. **3:** 17 (1913).

Rivers and lakes, southern Labrador, Quebec, and New Brunswick. MAP 16. Eurasia, northern Africa, Australia. The following are referred here: LABRADOR: Blanc Sablon R., Straits of Belle Isle (also on the Quebec side of the river), *Fernald, Wiegand & Long 27348;* Blanc Sablon R., Straits of Belle Isle, *Fernald & Wiegand 2450.* QUEBEC: Blanc Sablon R., Brest, Saguenay Co., *St. John 90087;* Blanc Sablon R., Blanc Sablon, Saguenay Co., *Lewis 130397;* Lac Pleureuse, Gaspé Co., *Fernald, Dodge & Smith 25421;* L'Ile Plate, Longueuil, near Montreal, *Victorin 20454.* NEW BRUNSWICK: Kennebecasis R., Lakeside, Kings Co., *Svenson & Fassett 933.*

13b. P. PERFOLIATUS L. var. BUPLEUROIDES (Fernald) Farwell

P. bupleuroides Fern., RHODORA **10:** 46 (1908); Hagstr., Crit. Res. Pot. 258 (1916). *?P. crispus* sensu Darlington, Fl. Cestr.

23 (1826); not L., Sp. Pl. **1:** 126 (1753). *P. perfoliatus* sensu Morong, Mem. Torr. Club **3:** no. 2: 33 (1893), in great part; sensu Graebn. in Engler, Pflanzenr. **4:** fam. 11: 92 (1907), in part; sensu Taylor, N. Am. Fl. **17:** pt. 1: 22 (1909), in part. *P. perfoliatus* var. *bupleuroides* Farw., Am. Mid. Nat. **8:** 264 (1923).

Brackish or fresh ponds and quiet rivers, Newfoundland to Florida, west to Ontario, Ohio, and Louisiana, common only in the northeastern part of its range. Map 17. Also Guatemala (Lake Atitlan, 1906, *C. M. Barber*) and probably elsewhere in Central America. The following are selected from a large series of specimens: Newfoundland: Killigrew's, Conception Bay, Avalon Peninsula, *Fernald & Wiegand 4484;* Holyrood, *Robinson & Schrenk 207* (G, type of *P. bupleuroides*, C, F, M, NY, US, isotypes); near Frenchman's Cove, Bay of Islands, *Mackenzie & Griscom 10049;* St. Georges, *Fernald, Wiegand & Kittredge 2451;* Highlands P., Crabbes, *Kennedy 551;* Topsail, *Williamson 472.* St. Pierre et Miquelon: Miquelon, *Louis Arsène 40 & 43.* Quebec: Percé, *Victorin, Brunel, Rolland & Rousseau 17286;* Newport, Gaspé Co., *Victorin, Rolland & Jacques 44467;* Dartmouth R., Gaspé Co., *Collins, Fernald & Pease 5578;* Saint-Augustin, Portneuf Co., *Victorin, Rolland & Jacques 33879;* St. Lawrence R., St. Vallier, Bellechasse Co., *Svenson & Fassett 3031;* Ile Plate, St. Lawrence R., Longueuil, *Victorin 8178 & 20456;* near Ottawa, *Victorin 10104.* Magdalen Islands: Cap-aux-Meules, Ile de l'Étang-du-Nord, *Victorin & Rolland 9924;* Étang-du-Nord wharf, Grindstone Island, *Fernald, Long & St. John 6771.* Prince Edward Island: Tignish, *John Macoun 3043;* Lower Sea Cow P., Prince Co., *Fernald, Long & St. John 6770;* Black P., Kings Co., *Fernald, Bartram, Long & St. John 6769.* New Brunswick: Restigouche R., Restigouche Co., *Svenson & Fassett 932;* Nipisiquit R., Bathurst, Gloucester Co., *Blake 5483;* St. John R., Westfield, Kings Co., *Fernald 1610 & 1611;* also *Fassett 2148;* Bass R., Kingston, Aug. 13, 1874, *J. Fowler.* Nova Scotia: South Ingonish, Cape Breton Island, *Nichols 694;* Mira Bay, Cape Breton Island, *Macoun 20756;* Bevis Brook, Port Bevis, Victoria Co., *Fernald & Long 19694;* Salmon R., Truro, Colchester Co., *Bean & White 19696;* Truro, Colchester Co., *Prince & Atwood 1405;* Port Clyde, Shelburne Co., *Fernald & Long 23143;* Midway (Centreville) L., Centreville, Digby Co., *Graves & Linder 19693;* Sable Island, *St. John 1124.* Maine: Mattawamkeag L., Island Falls, Aroostook Co., Sept. 7, 1897, *Fernald;* also *Pease & Hopkins 22692;* also *Steinmetz 374;* Pushaw P., Glenburn, Penobscot Co., *Ogden & Steinmetz 1544;* Bradley, July 29, 1905, *Ora Knight;* Souadabscook Stream, Hampden, Penobscot Co., *Fernald & Long 12392;* Eagle L., Piscataquis Co., *Ogden 1701;* Indian P., St. Albans, Somerset

Co., *E. C. & E. B. Ogden 2008;* South Paris, Oxford Co., 1897, *Furbish;* Roque Bluffs, Washington Co., Aug. 6, 1932, *Knowlton;* Mt. Desert I., Hancock Co., many collectors; Winterport, Waldo Co., *Rossbach 77;* Thomaston, Knox Co., Aug. 15, 1913, *E. B. Chamberlain;* also Aug. 14, 1915, *A. H. Norton;* Sheepscot R., Alna, Lincoln Co., *Fassett 456;* Sydney, Kennebec Co., *Fernald & Long 12391;* Topsham, Merrymeeting Bay, Sagadahoc Co., *Steinmetz 526;* Scarboro, Cumberland Co., *Fellows 4679;* Old Orchard, York Co., *Fernald 1612;* also *Chamberlain & Knowlton 571;* also *Parlin 1073;* also *Fellows 2966.* NEW HAMPSHIRE: Connecticut R., Northumberland, Coös Co., *Pease 12143;* Melvin, Merrimack Co., Aug. 15, 1904, *M. A. Day;* also *Sargent 29;* Rye Beach, Rockingham Co., Aug. 24, 1886, *Walter Deane;* Smith R., Danbury, Merrimac Co., Aug. 23, 1933, *Charles Bullard;* Rollinsford, *Hodgdon 11.* VERMONT: Maidstone, Essex Co., *Sanford 1225;* Willoughby L., Aug. 31, 1917, *E. J. Winslow;* Missisquoi R., Swanton, Franklin Co., *Blewitt 4319;* Missisquoi R., Sheldon, Franklin Co., *Blewitt 4320;* Pelot's Bay, Lake Champlain, Aug. 2, 1899, *Nellie F. Flynn;* also *Carpenter 6069;* Winooski R., Essex Junction, Chittenden Co., *Blake 2212;* Winooski R., Montpelier, Washington Co., *Svenson & Fassett 3040.* MASSACHUSETTS: Chadwick's P., Haverill, Essex Co., *Harris 540;* Mystic P., Medford, Middlesex Co., many dates, *Morong;* Fresh P., Cambridge, Middlesex Co., many collectors; Wareham, Plymouth Co., *Svenson & Smith 822;* Mashpee, Barnstable Co., *Fogg 3606;* Tashmoo L., Tisbury, Dukes Co., Marthas Vineyard, *Seymour 1027;* Marthas Vineyard, *McAtee 1060;* Washing P., Nantucket Island, *Bicknell 118;* also Sept. 8, 1909, *J. R. Churchill;* Congamond P., Southwick, Hampden Co., *Seymour 267;* Horse P., Westfield, Hampden Co., *Markert 76909;* Housatonic R., Stockbridge, Berkshire Co., Aug. 20, 1902, *R. Hoffmann.* RHODE ISLAND: Roger Williams Park L., Providence Co., July 23, 1908, *T. Hope;* Little Compton, Newport Co., *Sanford 10192;* Wash P., Block Island, Newport Co., *Fernald, Hunnewell & Long 8445.* CONNECTICUT: Selden's Cove, Lyme, New London Co., Sept. 6, 1911, *E. B. Harger;* Paton Brook, Southington, Hartford Co., Aug. 28, 1900, *C. H. Bissell;* Fenwick, Middlesex Co., Sept. 2, 1884, *C. Wright;* East Haven, New Haven Co., *Blewitt 1677 & 1978;* Pistapaug P., Wallingford, New Haven Co., *Blewitt 3651;* Ash Creek, Fairfield, July 6, 1895, *E. H. Eames.* NEW YORK: White Creek, De Kalb, *Phelps 1092 & 1655;* Rockland L., Rockland Co., *Muenscher & Curtis 5436;* Onondaga L., Aug. 1, 1890, *L. M. Underwood;* Schroon L., Warren Co., *Muenscher & Lindsey 2728;* Round L., Saratoga Co., *Muenscher & Clausen 4210;* n. of Canoga Marshes, Cayuga L., Seneca Co., *Eames & Wiegand 9102;* Riverhead, Southampton, Suffolk Co., *St. John 2542.* NEW JERSEY: Mantoloking, Ocean Co., *Edwards*

& Clausen 1400; Barnegat Bay, 1852, *O. R. Willis;* New Durham, July 21, 1864, *W. H. Leggett;* Hackensack R., Oradell, Oct. 10, 1891, *Morong;* Swartswood L., Sussex Co., *Griscom & Mackenzie 10680.* PENNSYLVANIA: Delaware R., Bushkill, Pike Co., Aug. 4, 1918, *E. B. Bartram* (G). DELAWARE: Brandywine, Wilmington, Aug. 17, 1896, *A. Commons* (M, NY). MARYLAND: off mouth of Mill Creek, Chesapeake Bay Region, *Shull 96;* Carroll Island, *Coville 114 & 118;* Oxon Run, *Tidestrom 7175;* Pomonkey Creek near Potomac R., June 24, 1906, *Tidestrom;* Rock Point, Charles Co., *Leonard & Killip 863.* VIRGINIA: Four Mile Run, Chesapeake Bay Region, *Shull 469;* Four Mile Run, Alexandria, Sept. 23, 1903, *Tidestrom;* Aquia Creek, Aug. 12, 1930, *Hugh O'Neill;* Dyke, Fairfax Co., *Metcalf & Sperry 1603;* Back Bay, Long Island, Princess Anne Co., *Fernald & Long 10873* (locally called "Red-top"). NORTH CAROLINA: North Channel, Currituck Sound, *Shull 456* (G, M, NY, US). FLORIDA: Apalachicola, no date, herb. *Chapman* (G, NY). ONTARIO: Almonte, July 7, 1898, *J. Fowler* (F); Cache L., Algonquin Park, *Macoun 22227* (C, not typical). OHIO: Put-in-Bay, Aug. 1898, *A. J. Pieters* (US); Ohio Canal near Roscoe, *J. L. Riddell* (G, US). ALABAMA: Mobile, July 1884, *C. Mohr* (S, US). LOUISIANA: Chifuncte Lighthouse, Lake Ponchartrain, Aug. 16, 1838, *Riddell* (US).

P. perfoliatus exhibits such an amount of variation that one might suppose it to include many varieties, yet these variants grade so insensibly into each other that lines can scarcely be drawn. Here, however, one is justified in refusing to give the variants formal rank, for they are sometimes found coming from the same rhizome, or as branches of the same plant.

In America, two extremes appear to deserve varietal recognition. One of these, a plant sparingly found in the cooler parts of northeastern North America, cannot be distinguished from *P. perfoliatus* of Europe. It approaches var. *gracilis* C. & S., which, being based entirely on variable foliage-characters, scarcely merits recognition as a genetic entity. Our plant is considered to be var. *typicus.* The few specimens from North America are all sterile. The other variety in North America is a smaller plant, with slender stem and delicate leaves having few prominent nerves. It is abundant from Newfoundland to New York and fruits freely. This latter plant has been separated from *P. perfoliatus* as *P. bupleuroides.* In its typical development in the brackish ponds of eastern Massachusetts, this plant differs so strikingly in size from the robust typical variety that, were it

not for the transitional forms so common in Maine, Quebec, and New York, it might well be regarded as a separate species.

In view of the fact that typical *P. perfoliatus* of Europe may have branches with foliage matching that of the variety *bupleuroides*, and that in patches of the latter variety there may occasionally be found plants bearing robust leaves approaching those of the typical variety, it seems best to treat them both as variants of the same species. Any differences in the fruits of var. *bupleuroides* and var. *typicus* of Europe are too slight and inconsistent to be used for distinguishing the varieties.

The remarks of Fryer as to the variability of *P. perfoliatus* in Europe are of importance here:

> *Potamogeton perfoliatus* has so considerable an amount of variation both in the shape and colour of the leaves that at first sight it seems easily separable into distinct varieties, but the examination of a good series, even of dried specimens, shows that the most extreme forms pass into one another so gradually that they are probably nothing more than *states* produced by local and often temporary conditions. An isolated plant growing in a newly dug clay pit afforded unusually good opportinuties for observation during several years, and this plant changed so much in the shape, colour, and even texture of the leaves, that I am further induced to think that all our British forms are mere states, not true varieties. When first noticed this single plant was very small, apparently a seedling of the year, and the leaves were elongated, thin, and diaphanous, . . . After three or four years the whole plant grew coarser in texture and the leaves were more horny, . . . Ultimately the plant spread and occupied a considerable part of the little pit in which it grew, and became so like the ordinary state of the species that I ceased to observe it, thinking that it had afforded sufficient proof that the texture and shape of the leaves are too inconstant to afford satisfactory grounds for varietal distinction.[1]

Mrs. Arber took a typical shoot of *P. perfoliatus* in July and kept it floating in a rain-water tub. "By October 1 most of the large perfoliate leaves had decayed and those on the new shoots were so much narrower and less perfoliate as to make it difficult to believe that they belonged to the same species."[2]

The work of the Pearsalls[3] with this species is very illuminating. Their ecological observations and experiments with plants of lakes and on those grown in tanks, led them to the conclusion that light intensity played a very great part in the shape of the leaf. However, leaf-shape was also influenced by other factors;

[1] Alfred Fryer, Pot. Brit. Isles 41 (1900).
[2] Agnes Arber, Water Plants 58 (1920).
[3] W. H. Pearsall & W. H. Pearsall, Journ. Bot. **61**: 2 (1923).

the nature of the soil probably being the primary one. Plants on calcareous soil tended to have broader leaves than those of acid waters. In America var. *bupleuroides* appears to vary according to the chemical nature of the water. Plants of brackish water invariably have small ovate leaves; those of neutral or acid waters tend to have their leaves larger and of a more elongate shape.

Hybrids

As nearly all *Potamogeton*-hybrids lack fruit and as flowers among the broad-leaved species are of slight, if any, value in distinguishing entities, it is necessary to base one's opinions as to the probable parents on the characters of the leaves and the anatomy of the stem. It is important that both parents be found in the general vicinity of the hybrid they are supposed to have produced, though there is some question if this needs to be so, for such a hybrid may reproduce vegetatively and persist for long periods of time, sometimes, perhaps, after a parent has ceased to exist in that vicinity. Although interspecific hybrids (except *P. gramineus* × *illinoensis*) seem not to form mature fruit, they often produce pollen, some of which appears to be viable. It is suspected that in this way they backcross with the parents, producing plants which strongly simulate a given species, but show evidences of influence from some other species. In some such cases one parent can be named with assurance, the other with less confidence. In many such cases it seems wisest to correlate the plant with the species to which it shows the strongest affinity, even though in some minor details it does not agree with the normal development of the species with which it is placed. Unless this be done, the number of hybrids might be so great as to make a treatment unwieldy. It may well be that hybrids backcrossing with the parents will eventually supplant one or both parents, which will then not be found in the immediate vicinity of the hybrid.

Hybrids should be considered, not as taxonomic units in themselves, but as blends of two (or more) distinct entities. Most hybrids cannot be described, except by saying "intermediate between the parents." No attempt is made, except where quite obvious, to determine what variety of a species is the parent, nor is attempt made to designate which is the female and which the

male parent. For many collections both parents could not be definitely determined. Most of these are, however, cited and in some cases discussed under the hybrid that is most probable, as determined from herbarium sheets. I hope that collectors who are acquainted with some of the cited localities will observe the plants in the field, for it is among the growing plants that hybrids can be more easily recognized and their parents determined.

P. ALPINUS × NODOSUS

P. alpinus × *nodosus* (× *P. subobtusus*) Hagstr., Crit. Res. Pot. 147 (1916). Not *P. alpinus* × *americanus* (× *P. rectifolius*) Bennett, Journ. Bot. **40:** 147 (1902); nor Graebn. in Engler, Pflanzenr. **4:** fam. 11: 132 (1907). Not *P. alpinus* × *americanus* (× *P. Faxoni*) Robinson & Fernald in Gray, Man. ed. 7: 73 (1908). Not *P. Faxoni* Morong, Mem. Torr. Club **3:** no. 2: 22 (1893); nor Taylor, N. Am. Fl. **17:** pt. 1: 20 (1909). Not × *P. Faxoni* Bennett, Journ. Bot. **46:** 248 (1908). Not *P. alpinus* var. *Faxoni* Stevens, Ill. Guide to Fl. Pl. 96 (1910).

This hybrid is extremely difficult to recognize for seldom are both parents obvious and the stem-anatomy of the two is so similar that it is of little help except to exclude from the parentage all species with dissimilar anatomy of the stem. Hagström cites but one specimen, which, then, is the type of × *P. subobtusus:* "'Nov. Ebor.', E. Tuckerman Jr (hb. Upps.)." Material in the Gray Herb. and New York Bot. Gard. Herb., which is probably isotypic, may well be this hybrid; both are mixed with typical *P. alpinus* var. *tenuifolius.* Other collections which may be this hybrid are: NEW YORK: in a canal or raceway at Niagara Falls, Aug. 21, 1886, *Morong* (G); Niagara R., Aug. 23, 1886, *Coville* (US); Normans Kill, Kenwood, *C. H. Peck 2* (US).

P. ALPINUS × GRAMINEUS

?P. alpinus × *gramineus* (× *P. nericius*) Hagstr., Crit. Res. Pot. 145 (1916).

No American specimens can be cited that are undoubtedly this hybrid. However, plants growing in Mattagodus Stream, Prentiss, Penobscot Co., MAINE, which I studied and collected (*Ogden & Wright* 2342) may possibly be this hybrid. It grew in close proximity to *P. alpinus* v. *tenuifolius* and *P. gramineus.* It is, however, more likely to be *P. gramineus* × *P. perfoliatus* var. *bupleuroides;* the latter species was not found in the im-

mediate vicinity, but is plentiful in the region. Other collections that might belong here are: Churchill, Manitoba, *Polunin 2070* (C, G, this might be *P. gramineus* × some linear-leaved species. *P. gramineus* is quite obviously a parent, but there are no interlacunar bundles in the stem, and the reddish color suggests *P. alpinus*); Okanogan R., Washington, *Sereno Watson 396* (G); Catfish L., Algonquin Park, Ontario, *Macoun 22220* (C). Collections from Quebec: Hull Brook, *Harrington 99100;* Brigham's Creek, Hull, *John Macoun 85531;* also *Malte 118259, 118260, 118261 & 118262*, may be this hybrid.

P. amplifolius × illinoensis

?P. amplifolius × *illinoensis* (× *P. scoliophyllus*) Hagstr., Crit. Res. Pot. 164 (1916); *?*× *P. scoliophyllus* forma *barensis* Hagstr., ibid.

Hagström cites a specimen from Bear Lake, Manistee, Michigan, collected by Morong in 1882 as the type for × *P. scoliophyllus*, and on the supposition that a form might someday be found differing from this, further named the Bear Lake plant: forma *barensis*. None of the collections of Morong from Bear Lake, Manistee, Mich. that I have seen appears to be this hybrid, though both *P. amplifolius* and *P. illinoensis* are represented. Hagström reports this hybrid also from Cedar Lake, Ont. and Buckingham, Que., but cites no specimens. I have seen no specimen that I would refer here.

P. amplifolius × praelongus

Collections that may be this are: Wisconsin: Green Bay, sloughs between Halfway Slough and Bass Channel, June 29, 1890, *J. H. Schuette* (F); Green Bay, between Duck Creek Channel and Bars Channel, nearer to the latter, July 17, 1890 (or 1899?), *J. H. Schuette* (F); Green Bay, June 23, 1891, *J. H. Schuette* (F). New York: very abundant, Southeast Bay, Saratoga L., Saratoga Co., *Muenscher & Lindsay 2814b* (G). Vermont: Tinmouth P., Tinmouth, Aug. 5, 1907, *G. G. Kennedy* (G).

P. amplifolius × Richardsonii

A collection from the north end of Tupper L., Franklin Co., New York, *Muenscher & Clausen 3784* (G), may be this hybrid.

P. epihydrus var. Nuttallii × pulcher

Virginia: outlet of Lee's Millpond, Isle of Wight Co., *Fernald & Long 12230* (G).

P. NATANS × NODOSUS

?× *P. perplexus* (*nodosus* × *natans*), Benn., Trans. & Proc. Bot. Soc. Edinburgh **29:** 53 (1924).

Bennett considers a collection from: BRITISH COLUMBIA: Sumas L., Chilliwack Valley, *J. M. Macoun 26815* to be this hybrid and makes it the type of × *P. perplexus*. It may be this, but from the three sheets in the National Museum of Canada (TYPE), the Gray Herbarium, and the New York Botanical Garden, it appears to me to be a typical *P. illinoensis*.

P. GRAMINEUS × NODOSUS

?× *P. argutulus* Hagstr., Bot. Not. 106 (1908); Hagstr., Crit. Res. Pot. 220 (1916). ?× *P. argutulus* formseries *nodosifolius* Hagstr., Bot. Not. 106 (1908); ? Hagstr., Crit. Res. Pot. 220 (1916).

The following may belong here: MAINE: Merrymeeting Bay, Topsham, Sagadahoc Co., *Steinmetz 527* (G, ME, O); Sunkhaze Stream, Milford, Penobscot Co., *Ogden & Steinmetz 1607* (O). NEW HAMPSHIRE: Connecticut R., Cornish, Sept. 2, 1886, *F. H. Knowlton* (US). NEW YORK: Spencer L., Spencer, Tioga Co., *Thomas 1494* (G); east shore of Hudson R., above Coveville, Washington Co., *Muenscher & Lindsey 2715* (O). DISTRICT OF COLUMBIA: in the vicinity of Washington, Aug. 5, 1879, *L. F. Ward* (US). WEST VIRGINIA: Greenbrier R., Talcott, Summers Co., *Morris 1343* (F, US, possibly *P. illinoensis* × *nodosus*).

P. ILLINOENSIS × NODOSUS

P. alpinus × *pensylvanicus* Benn., Journ. Bot. **28:** 301 (1890). *P. Faxoni* Morong, Mem. Torr. Club **3:** no. 2: 22 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11:75 (1907); Taylor, N. Am. Fl. **17:** pt. 1: 20 (1909). ? *P. lonchites* × *rufescens* Morong, Mem. Torr. Club **3:** no. 2: 22 (1893). ? *P. alpinus* × *Claytonii*, Graebn. in Engler, Pflanzenr. **4:** fam. 11: 75 & 132 (1907). × *P. Faxoni* = *P. americanus* × *pensylvanicus* Benn., Journ. Bot. **46:** 248 (1908). × *P. champlainii* = *P. alpinus* × *pensylvanicus* Benn., Journ. Bot. **46:** 248 (1908). × *P. Faxoni* = *P. alpinus* × *americanus* Robinson & Fernald, Gray Man. ed. 7: 73 (1908). *P. alpinus* var. *Faxoni* Stevens, Ill. Guide to Fl. Pl. 96 (1910). *P. illinoensis* × *nodosus* Hagstr., Crit. Res. Pot. 200 (1916). *P. lucens* × *nodosus* (× *P. subrufus*) Hagstr., Crit. Res. Pot. 241 (1916).

The following are referred here: QUEBEC: Ile Bizard, *Adrien 1442* (G, MT). VERMONT: Little Otter Creek, Ferrisburg, Aug. 10, 1880, *C. E. Faxon* (G, MSC, NE, NY, US, type of *P. Faxoni* in NY); Aug. 20, 1880, *C. E. Faxon* (G, NE); Little Otter Creek, near Barnum's Mill and Ferrisburg Station, Ferrisburg, Aug. 19,

1882, *Edwin Faxon* (G, NE, NY), Aug. 23, 1882, *Edwin Faxon* (F, G, NE, NY): Otter Creek, below Vergennes, Addison Co., Aug. 24, 1882, *Edwin Faxon* (NE); Otter Creek, Middlebury, Sept. 5, 1896, herb. *Ezra Brainerd* (G); Little Otter Creek, near Lake Champlain, Ferrisburg, Addison Co., *Ogden & Bolan 1589½* (G); Lewis Creek, Ferrisburg, Aug. 20, 1881, *E. & C. E. Faxon* (G, US), Aug. 18, 1882, *Edwin Faxon* (F, G, NY, isotypes of × *P. champlainii*). New York: Lake Champlain, Plattsburg, Aug. 19, 1885, *Morong* (C, G, NY); outlet of Lake Seneca, Geneva, Aug. 14, 1884, *Morong* (C, G, NY, cotype collection of × *P. subrufus*). Virginia: northeast part of Four-mile Run, Chesapeake Bay region, *Shull 471* (G, NY, US). Missouri: Cooley L., Clay Co., *Metcalf 1055* (US). Texas: Cebelo Creek, near Boerne, Kendall Co., *E. J. Palmer 12907* (G, NY, US, possibly not this hybrid). Idaho: Altmas L., *Evermann 490* (F, possibly not this hybrid).

P. nodosus × Richardsonii

× *P. rectifolius* (*americanus* × *alpinus*) Benn., Journ. Bot. **40:** 147 (1902); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 132 (1907); Robinson & Fernald, Gray Man. ed. 7: 73 (1908). *P. americanus* Taylor, N. Am. Fl. **17:** pt. 1: 19 (1909), in part. *P. nodosus* × *Richardsonii* Hagstr., Crit. Res. Pot. 148 (1916).

Illinois: Railroad ditch, Stoney Island, Chicago, Sept. 14, 1900, *E. J. Hill 171.1900* (NY, isotype material of × *P. rectifolius*), Aug. 30, 1901, *Hill 179.1901* (C, isotype material of × *P. rectifolius*), Sept. 6, 1902, *Hill 191.1902* (G), also *Agnes Chase 1477* (F) & *1994* (F). Oregon: Sauvie's Island, *Thomas Howell 1497* (US).

P. epihydrus × nodosus

? *P. americanus* × *pensylvanicus* Benn., Journ. Bot. **46:** 250 (1908); not Benn., Journ. Bot. **46:** 248 (1908). *P. nodosus* × *Nuttallii* (× *P. subsessilis*) Hagstr., Crit. Res. Pot. 190 (1916).

Bennett mentions ". . . specimens gathered in New York and eastern Massachusetts by the late Dr. Morong . . . " and Hagström cites what may be the same Massachusetts collection. From Hagström's description and an examination of the specimens, it is obvious he refers to Morong's collection from Winchester, Massachusetts, Sept. 1, 1880 (NY), Aug. 8, 1881 (C, NY), Aug. 29, 1881 (G, 2 sheets, one mixed with *P. nodosus*), which is quite probably this hybrid.

P. gramineus × natans

? *P. natans* × *gramineus* (× *P. sparganifolius*) Hagstr., Crit. Res. Pot. 197 & 217 (1916).

Hagström cites: Pine Plains, NEW YORK, *Hoysradt*. What may be the same collection appears to me to be *P. gramineus*.

P. GRAMINEUS × ILLINOENSIS

P. Proteus Zizii C. & S., Linnaea **2:** 201 (1827), in part. *P. gramineus* var. ? *spathulaeformis* Robbins in Gray, Man., ed. 5: 487 (1867); not sensu Fern., RHODORA **23:** 190 (1921), nor RHODORA **35:** 130 (1933). *P. heterophyllus* forma *maximus* Morong, Mem. Torr. Bot. Club **3:** no. 2: 25 (1893), in part. *P. spathulaeformis* Morong, Mem. Torr. Club **3:** no. 2: 26 (1893); Graebn. in Engler, Pflanzenr., **4:** fam. 11: 91 (1907), as *P. spathuliformis*. *P. spathaeformis* Tuckerm. in herb., Robbins in Gray's Man. ed. **5:** 487 (1867), as a synonym; Benn., Journ. Bot. **38:** 130 (1900). × *P. spathaeformis* Fern., RHODORA **8:** 224 (1906); Robinson & Fern. in Gray, Man., ed. **7:** 74 (1908). *P. varians* Fryer, Journ. Bot. **27:** 308 (1889), as to American specimens. ? *P. Zizii* var. *porrectifolius* Benn. ex Graebn. in Engler, Pflanzenr. **4:** fam. 11: 83 (1907). ? *P. Zizii* var. *gracilis* Benn. ex. Graebn. in Engler, Pflanzenr. **4:** fam. 11: 83 (1907). ? *P. gramineus* × *Zizii* (× *P. spathuliformis*) Graebn. in Engler, Pflanzenr. **4:** fam. 11: 136 (1907). *P. angustifolius* Taylor, N. Am. Fl. **17:** pt. 1: 18 (1909), in part. *Spirillus Zizii* Nieuwland, Am. Mid. Nat. **3:** 17 (1913), in part. *P. illinoensis* × *lucens* (× *P. pseudolucens*) Hagstr., Crit. Res. Pot. 199 (1916). *P. gramineus* × *illinoensis* (× *P. deminutus*) Hagstr., Crit. Res. Pot. 209 (1916). *P. gramineus* × *illinoensis* × *lucens* (× *P. pseudo-Zizii*) Hagstr., Crit. Res. Pot. 210 (1916). *P. gramineus* × *lucens* (× *P. Zizii*) Hagstr., Crit. Res. Pot. 210 (1916). × *P. Zizii* forma *pulcherrimus* Hagstr., Crit. Res. Pot. 214 (1916). *P. angustifolius* of Am. auth., in part; not Bercht. & Presl, Rostlin **2:** Alismac. 19 (1821). *P. Zizii* of Am. auth., in part; not M. &. K. in Röhling, Deutschl. Fl. **1:** 845 (1823); nor Koch ex Roth, Enum. Plant. Germ. **1:** 531 (1827).

Of the numerous collections, the following may be mentioned: VERMONT: Lake Champlain, Alburgh, Aug. 22, 1885, *Morong* (NY, isotype of × *P. Zizii* forma *pulcherrimus*); Windmill Point Reef, Alburg, Grand Isle Co., *Muenscher, Manning & Maguire 73* (F); Lake Bomoseen, Castleton, Oct. 1, 1898, *W. W. Eggleston* (US). MASSACHUSETTS: Medford, herb. Tuckerman (NY, type of *P. gramineus* var. *spathulaeformis*, G, isotype); Mystic P., Medford, Oct. 8 & Sept. 24, 1865, some sheets without date, *Robbins* (G, MSC, NY, cotype material of *P. gramineus* var. *spathulaeformis*); also July 10, 1879 (G), July 25, 1879 (G, NY), Aug. 5, 1879 (NY), Aug. 11, 1879 (F, NY), Sept. 1, 1879 (NY), Sept. 15, 1879 (F, NY), Aug. 5, 1881 (MSC, NY), July–September (C), all by *Morong*; also July 27, 1880, *E. & C. E. Faxon*

(G, US); Fresh P., Cambridge, Sept. 5, 1853, Sept. 27 and Oct. 24, 1865, herb. *Wm. Boott* (G); also Sept. 21, 1867, *Robbins* (NY); also Aug. 1876 (F), July 25, 1879 (F, NY), Aug. 2, 1879 (US), July 13, 1880 (MSC) and Sept. 14, 1886 (NY), *Morong;* also Sept. 17, 1880, *C. E. Faxon* (G); Pleasant P., Wenham, Sept. 13, 1880, *E. & C. E. Faxon* (C, F, G, NY, US); also Sept. 9, 1881, *Morong* (NY); also *E. C. & E. B. Ogden, 1762* (O). Connecticut: Lake Saltonstall, Sept. 22 & 23, 1880, *E. Faxon* (G, US). New York: Cossayuna L., Washington Co., *Muenscher & Lindsey 2786* (F, G); Perch L., Jefferson Co., *Muenscher & Maguire 1684* (G); Lake Champlain, s. of Fort Ticonderoga, Essex Co., *Muenscher, Manning & Maguire 75* (F); Junius, near Geneva, *Baxter 5399* (US); Phillips P., Junius, Seneca Co., *Eames & MacDaniels 3463* (G); Pine Plains, *L. H. Hoysradt* (G). Ontario: McKay's L., near Ottawa, *Malte 118258* (G, V); cove above Grass Creek Island, 7 miles below Kingston, Frontenac Co., *Pennell 16333* (NY). Michigan: Crystal Falls, Iron Co., *Metcalf 2253* (US) & *2256* (G, US); Pine L., Ingham Co., 1893, *C. F. Wheeler* (C, mixed with *P. illinoensis*); Cassidy L., near Chelsea, Washtenaw Co., *Hermann 9294* (NY). Indiana: Grassy Creek, near Tippecanoe L., *Scovell 37* (US); bed of inlet to Gage L., Steuben Co., June 17, 1903, *C. C. Deam* (NY); e. side of Lake James and w. side of Pokagon State Park, Steuben Co., *Deam 56537* (G); Fletcher L., near Fulton, Fulton Co., *Deam 56524* (G); Lake Maxinkuckee, *Evermann 544a* (US). Wisconsin: Green Bay near Suamico's shore, July 11, 1886, *J. H. Schuette* (G); n. side of Puckaway L., Green Lake Co., *Uhler & McLaughlin 375* (F, G) *& 1091* (US). Minnesota: Green L., Chisago Co., July 1892, *B. C. Taylor* (NY); Pelican L., Koochiching Co., *Metcalf 1532* (G, US); Deep L., Cass Co., *Metcalf 2373* (US); Snail L., Ramsey Co., *Oosting 28164* (NY). Iowa: Armstrongs Grove, Aug. 1881, *R. I. Cratty* (NY). Nebraska: West Chain L., *Thomson 73b* (US); Dewey L., *Tolstead 616* (G). Idaho: Priest L., *MacDougal 304* (C, NY); also *Piper 3761* (G, NY, US); Pend Oreille L., Bonner Co., *Muenscher 10208* (G, O) *& 10212* (O). Arizona: Montezuma Well, *Jackson 52* (US); also *Taylor 78* (US).

P. gramineus × Richardsonii

P. nitens sensu Benn., Journ. Bot. **39:** 200 (1901), in part; also Journ. Bot. **65:** 115 (1927), in part. *P. epihydrum* × *angustifolius* Benn., Journ. Bot. **42:** 71 (1904). *P. Claytonii* × *Zizii* Graebn. in Engler, Pflanzenr. **4:** fam. 11: 133 (1907). × *P. subdentatus* β *petiolatus* Hagstr., Crit. Res. Pot. 201 (1916). *P. Hagströmii* Benn., Trans. & Proc. Bot. Soc. Edinburgh **29:** 51 (1924).

The following appear to be this hybrid: Ontario: Lake Nipissing, *Chitty 265* (G). Michigan: St. Mary's R., Sault Ste. Marie,

E. J. Hill 133.1881 (C); northwest end of Brevort L., Moran, Mackinac Co., *Ogden & Bolan 1681* (G, O); Detroit R., Oct. 4, 1892, *Farwell 473a* (G); also Aug. 25, 1892, *Farwell* (G); also Oct. 4, 1892, *Farwell* (NY). ILLINOIS: Wolf L., Chicago, *Agnes Chase 1713* (F); also June 10, 1911, *Earl E. Sherff* (F). ALBERTA: Indian Graveyard, Peace R., Wood Buffalo Park, *Raup 1547* (C, G, NY). COLORADO: Carleton L., near Grand L., *Shear & Bessey 5333* (NY). BRITISH COLUMBIA: Griffin L., *Macoun 4179* (C, G, isotypes of × *P. subdentatus* β *petiolatus*); Sumas L., *J. M. Macoun 26816* (C, type of *P. Hagströmii*, G, NY, isotypes).

P. GRAMINEUS × PERFOLIATUS var. BUPLEUROIDES

? *P. nitens* sensu Morong, Mem. Torr. Club **3:** no. 2: 34 (1893). *P. gramineus* var. *spathulaeformis* sensu Fern., RHODORA **23:** 190 (1921) and RHODORA **35:** 131 (1933); not Robbins in Gray, Man. 5: 487 (1867). × *P. nitens* var. *subgramineus* f. *restrictus* Hagstr., Crit. Res. Pot. 223 (1916). × *P. subnitens* Hagstr., Crit. Res. Pot. 259 (1916).

The following are referred here: NEWFOUNDLAND: Highlands Brook above bridge, Crabbes, *Kennedy 78* (G); Otter P., Brig Bay, *Fernald, Wiegand, Long, Gilbert & Hotchkiss 27341* (F, G, probably backcrossed with *P. gramineus*); also *27342* (G, probably backcrossed with *P. gramineus*). QUEBEC: Matane R., Matane, Matane Co., Aug. 5, 1904, *Forbes 156* (C, G, one sheet of this collection in G is rather typical *P. perfoliatus* var. *bupleuroides*); Rivière Ouest, Gaspé Co., *Victorin, Rolland & Jacques 44459* (G, MT); Ile du Large, Iles de Boucherville, St. Lawrence R., *Victorin & Rolland 44738* (F, G); Berthier-en-bas, St. Lawrence R., *Rousseau 20444* (G); also *20445* (G, US, V); Ile Plate, St. Lawrence R., Longueuil, Chambly Co., *Victorin 8176* (G); also *28604* (C, G); also *Rolland 43361* (C, F, G); Ile Verte, St. Lawrence R., Longueuil, Chambly Co., *Rolland 43367* (G); also *43368* (F); also *43376* (G); also *43378* (G); also *43382* (F, G); Lac Aylmer, Wolfe Co., *Louis-Marie, Laporte & Dudemaine 301* (G). ANTICOSTI: Becscie R., *Macoun 2983* (C); Salt L., *Macoun 2986* (C). NEW BRUNSWICK: St. John R., Ingleside, Westfield, *Fernald 1609* (G); Hammond R., Hammond, Kings Co., *Svenson & Fassett 3025* (G); Jacquet R., Restigouche Co., *Svenson & Fassett 3030* (G); St. John R., Lincoln, Sunbury Co., *Fassett 2151* (G); Fredericton, July 30, 1892, *J. Fowler* (US); Campbellton, Aug. 26, 1905, *J. Fowler* (US). NOVA SCOTIA: "plaster hole lake" near Dingwall, Cape Breton Island, *Nichols 1037* (G); Shinimikas R., Northport, Cumberland Co., *Fassett 2150* (G); Midway (Centreville) L., Centreville, Digby Co., *Graves & Linder 19691* (G, perhaps backcrossed with *P. gramineus*). MAINE: St. John R., Madawaska, Aroostook Co., July 28, 1893, *Fernald* (G, NE, NY); Pushaw P., Oldtown, Aug. 21,

1899, *L. H. Harvey* (US); Pushaw P., Glenburn, Penobscot Co., *Ogden & Steinmetz 1544½* (G, O); Pushaw P., Hudson, Penobscot Co., *Ogden & Steinmetz 2195* (ME, O); Mattagodus Stream, Prentiss, Penobscot Co., *Steinmetz 320* (G, ME, O, possibly *P. alpinus* × *gramineus*); also *Ogden & Wright 2342* (ME, O, possibly *P. alpinus* × *gramineus*). New Hampshire: Connecticut R., Walpole, *Fernald 440* (G); mouth of brook, Melvin, *Sargent 31* (G). Vermont: Winooski R., Essex Junction, *Blake 2216* (US); Connecticut R., Brattleboro, 1865, *C. C. Frost* (G). Massachusetts: Wenham P., Sept. 13, 1880, *Edwin Faxon* (C, G, NY, US, see next citation); also Sept. 5, 1882, *Edwin Faxon* (G, NY, type collection of × *P. subnitens;* some of the Wenham Pond collections appear to be this hybrid, probably backcrossed with *P. perfoliatus* var. *bupleuroides;* some cannot be distinguished from ecological forms of *P. perfoliatus* var. *bupleuroides*). Connecticut: Taunton P., Newtown, *E. H. Eames 11733* (G); Beardsley P., Danbury, *E. H. Eames 11741* (G, possibly not this hybrid). New York: Hudson R., Mechanicville, Rensselaer Co., *Muenscher & Lindsey 2770* (G) & *2865* (G, O); Myers Pt., Cayuga L., Aug. 13, 1884, herb. *W. R. Dudley* (NY); Old Chenango Canal, near South Oxford, July 1, 1886, *F. V. Coville* (US); Chemung R. near Wellsburg, *Lucy 10843* (F); Chenango R., Brisben, June 28, 1887, *F. V. Coville* (US); slow stream, ½ mi. s. of the Jefferson Co. line, on route No. 3, n. w. of Sandy Creek, Oswego Co., *Ogden & Bolan 1578* (G, O). New Jersey: river-edge above Phillipsburg, July 23, 1886, *T. C. Porter* (NY). Pennsylvania: near Easton, Sept. 8, 1868, *T. C. Porter* (F). Virginia: Dyke, Fairfax Co., *Metcalf & Sperry 1684* (US). Ontario: Almonte, July 6 & 7, 1898, *J. Fowler* (F, G); Missinaibi R., *J. M. Macoun 2979* (C, G).

This cross is between species of relatively unrelated subsections and the progeny are extremely variable and often very odd. As with most hybrids among the broad-leaved species of *Potamogeton,* no description can be given that is both inclusive and limiting. The hybrid must be distinguished as an intermediate between the two parents. It often appears with floating leaf-blades tapering gradually into the petiole and with clasping submersed leaves having sharp-pointed apices. Mature fruit is unknown in interspecific crosses, but may occasionally appear in backcrosses. The anatomy of the stem shows a blend between the two parents, presenting all the possible combinations with a trio-type or oblong-type of stele, O-cells or U-cells in the endodermis, and cortical bundles present or absent. Next to *P. gramineus* × *illinoensis*, this is probably the most frequent *Potamogeton-*

hybrid in North America. It is one of the easiest to recognize. The nearest approach to it is *P. gramineus* × *Richardsonii* which can usually be distinguished by its coarser stipules.

P. GRAMINEUS × P. SP.

P. angustifolius var. *methyensis* Benn., Journ. Bot. **29:** 151 (1891). *P. Zizii* var. *methyensis* Benn. in Macoun, Cat. Can. Pl. 370 (1890); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 83 (1907). *P. methyensis* Benn., Trans. & Proc. Bot. Soc. Edinburgh **29:** 50 (1924).

Methye L., near Methye Portage, SASKATCHEWAN, July 18, 1888, *J. M. Macoun 4178* (C, TYPE of *P. methyensis*).

A number of collections are hybrids with *P. gramineus* quite evidently one of the parents. Among these is the Methye Lake plant upon which *P. methyensis* is based. From the single sheet seen by me I cannot determine the other parent. *P. illinoensis* might seem a good guess, but it is not reported so far north. *P. alpinus* and *P. Richardsonii* abound in the region, but I am unable to see marked influence of either of these species. Hagström may not have seen this collection; at least he mentions the name only in the index to his Critical Researches. He is, however, referring to it (among others) when he says, ". . . but many *Zizii*-like North American plants are not at all this hybrid, but of another origin, and great carefulness is necessary when considering these difficult forms."[1]

P. ILLINOENSIS × RICHARDSONII

INDIANA: Bass L., Starke Co., Aug. 7, *W. S. Blatchley* (Deam).

P. ILLINOENSIS × PERFOLIATUS var. BUPLEUROIDES

? × *P. subdentatus α sessilis* Hagstr., Crit. Res. Pot. 201 (1916); not × *P. subdentatus β petiolatus* Hagstr., ibid.

NEW YORK: Sodus Bay, *Killip 12264* (G, US); Onondaga L., Aug. 1, 1890, *L. M. Underwood* (NY). FLORIDA: Apalachicola, herb. *Chapman* (G, NY, US); mouth of Choctawhachee R., June 18, 1880, *C. Mohr* (US). ALABAMA: estuary of Mobile R., July 22, 1884, *C. Mohr* (US).

Hagström cites a specimen from Queenston, ONTARIO (without mentioning collector's name and date), which he considers to be *P. illinoensis* × *perfoliatus*. I have not seen this collection.

[1] Hagström, Crit. Res. Pot. 216 (1916).

The collection from Griffin L., British Columbia, which he also cites as having these parents, is *P. gramineus* × *Richardsonii*.

P. illinoensis × P. sp.

". . . a peculiar form of P. natans," Morong, Bull. Torr. Bot. Club **13:** 145 (1886). *P. floridanus* Small, Fl. Se. U. S. 37 and 1326 (1903); Benn., Journ. Bot. **45:** 376 (1907); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 62 (1907). ? *P. Tepperi* Benn., Journ. Bot. **45:** 373 (1907); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 62 (1907). ". . . apparently an immature form. . ." of *P. natans*, Taylor, N. Am. Fl. **17:** pt. 1: 16 (1909). "probably belonging to the group *Amplifolii*," Hagstr., Crit. Res. Pot. 268 (1916).

Florida: Blackwater R., May 1886, *A. H. Curtiss* (NY, type and isotype of *P. floridanus*); also June 22, 1886, *Curtiss* (NY).

Further collections and perhaps a study of the living plants will be needed to determine the exact nature of this plant. It is possible that it is a cross between *P. illinoensis* and a linear-leaved species. The stem-anatomy is: stele with the proto-type pattern, endodermis of U-cells, interlacunar bundles weakly developed and only in the outer interlacunar circle, subepidermal bundles absent or weakly developed, pseudo-hypodermis present or absent. Curtiss collected in the same river, and by the dates on the sheets presumably at the same time, fragmentary bits of *P. foliosus* Raf. var. *macellus* Fern. Other linear-leaved species of *Potamogeton*, subgenus *Eupotamogeton*, found in the general region are: *P. pusillus* L. (*P. panormitanus* Biv.), *P. Berchtoldi* Fieber (*P. pusillus* of auth., not L.), *P. diversifolius* Raf., and *P. capillaceus* Poir. None of these linear-leaved species has interlacunar bundles and all have O-cells in the endodermis, so if one is a parent, the other parent must possess interlacunar bundles and a U-celled endodermis. The only broad-leaved species agreeing with this would be *P. illinoensis*. The stelar pattern of the plant in question leads me to consider *P. pulcher* as a possible parent, though it lacks interlacunar bundles and has an O-celled endodermis. In such case, the only linear-leaved species that can be considered to be the other parent is *P. pectinatus*, in the subgenus *Coleogeton;* it being the only linear-leaved species in the region with interlacunar bundles and with U-cells in the endodermis. It is possible that the plant is a pronounced eco-

logical form of *P. Oakesianus* or *P. natans*, neither of which has been otherwise found within 600 miles of Florida.

P. PRAELONGUS × RICHARDSONII

MICHIGAN: Saulte Ste. Marie, Aug. 4, 1881, *E. J. Hill* (US). UTAH: Fish L., Sevier Co., *Tanner 5786* (F).

P. PERFOLIATUS var. BUPLEUROIDES × RICHARDSONII

It is reasonable to suppose that the two closely related species, *P. Richardsonii* and *P. perfoliatus*, would hybridize rather freely where their ranges overlap. Such appears to be the case, for these species remain quite recognizable (though exhibiting much ecological variation) throughout their separate ranges, but where these ranges overlap, all intergradations occur. One might consider the entities that bridge the narrow gap to be those from which the two species have evolved were it not that such plants are always sterile and often exhibit other evidences of hybridism. Such plants occur in Quebec, northern Maine, New Hampshire, and are especially abundant in New York. They occasionally occur elsewhere. Although the evidence is strongly in favor of numerous hybrids between *P. Richardsonii* and *P. perfoliatus* var. *bupleuroides*, it is practically impossible to be sure of this with individual collections, for ecological or other conditions of growth might cause a simulation of this in either of these closely related species. For this reason, no collections are cited.

P. BERCHTOLDI × PERFOLIATUS var. BUPLEUROIDES

RHIZOME extensively creeping. STEM terete .4–.7 mm. in diameter, usually branched; stele with the oblong-type pattern (sometimes with the 1-bundled-type pattern), endodermis of non-stratified O-cells; interlacunar and subepidermal bundles absent, or with a few weakly developed subepidermal ones; pseudo-hypodermis 1 cell thick. LEAVES all submersed, delicate, oblong to oblong-linear, .5–4 cm. long, .2–.6 cm. wide; nerves 3–7; sessile and cuneate at base, semi-clasping; apex obtuse or acutish, but not sharp-pointed; margin entire (with 1-celled denticles on the Nantucket specimen); lacunae of 1 or 2 rows of cells each side of the midrib, commonly with a pair of glands at the base. STIPULES delicate, more or less persistent, ovate-oblong, rounded at apex, .3–1.5 cm. long, without keels. PEDUNCLES about same thickness as stem, sometimes slightly incrassate, 1–4 cm. long. SPIKES with 1–4 whorls, not crowded at anthesis; in flower .2–.5

cm. long, .2–.3 cm. thick. Flowers sessile; sepaloid connectives greenish, blades orbicular or elliptical, 1–1.8 mm. wide, claws .6–.8 mm. long; anthers .7–1 mm. long. Mature Fruits unknown. Immature fruits obovate, about .9 mm. long (excluding beak) and .8 mm. wide; beak prominent, about .5 mm. long, curved toward the back; keels none; exocarp greenish; seed aborted, apex pointing toward basal end. Winter Buds abundantly produced late in the season, mostly near the rhizome, with leaves appressed to the shortened axis, or tightly appressed for about half their length and with the upper halves strongly divergent; basal glands prominent and forming adventitious roots.

P. mysticus Morong, Bot. Gaz. **5:** 50 (1880); Mem. Torr. Club **3:** no. 2: 34 (1893); Graebn. in Engler, Pflanzenr. **4:** fam. 11: 95 (1907); Robinson & Fern. in Gray, Man. ed. 7: 75 (1908), with suggestion that it is "probably a hybrid" of *P. bupleuroides* (*perfoliatus* var. *bupleuroides*) and *P. pusillus* (*Berchtoldi*); Taylor, N. Am. Fl. **17:** pt. 1: 22 (1909), "apparently a depauperate form" of *P. perfoliatus*, and "may be a hybrid"; Britton in Britt. & Brown, Ill. Fl. **1:** 80 (1913) "apparently a depauperate form" of *P. perfoliatus* and "Perhaps a hybrid." *P. bupleuroides* × *pusillus* (× *P. mysticus*) Hagstr., Crit. Res. Pot. 259 (1916).

In brackish water, Maine, Massachusetts, and Maryland. The following are referred here: Maine: Dunston Marshes, Scarboro, Sept. 20, 1920, *A. H. Norton;* Stuart Brook, West Scarboro, Scarboro, Cumberland Co., *Steinmetz & Marston 539, Plantae Exsiccatae Grayanae 905;* also *Steinmetz* 617; also *Ogden, Rollins & Wiggins 1731;* Lily P., Fortune Rocks, Biddeford, Sept. 3, 1899, *G. G. Kennedy.* Massachusetts: Mystic P., Aug. 13 and Sept. 3, 1865, *Wm. Boott;* Mystic P., Medford, on several dates in 1879, 1880, and 1881 by *Morong* and the *Faxons;* Miacomet P., Nantucket, July 13, 1887, *Morong.* Maryland: near Ocean City, *H. L. Clark 6.*

This interesting hybrid was evidently first collected by Wm. Boott in Mystic Pond (now called Mystic Lakes) in 1865. In 1879 Morong found the plant still there, and in 1893 wrote, "Since I obtained this . . . in 1879, I have visited the locality for several years in succession, and, though I have always found the plant growing vigorously, yet it has shown no signs of prefecting [sic] fruit."[1] In the summers of 1935, '36 and '37 I searched the Mystic Lakes carefully for it without success. The town of Medford extends only into the lower lake where *P. perfoliatus* var. *bupleuroides* now abounds. In this lower lake no

[1] Morong, Mem. Torr. Club. **3**: no. 2: 35 (1893).

P. Berchtoldi was seen, but there is in the middle lake, now separated from the lower by a dam, a flourishing patch of *P. Berchtoldi* var. *tenuissimus*. This var. of *P. Berchtoldi* was found with the hybrid at Scarboro, Maine, and it appears safe to designate this variety as one of the parents of the Mystic Lakes and Scarboro plants. Whether it is this variety of *P. Berchtoldi* which is a parent of the other specimens cannot be said. A search at the Scarboro locality, where the plant thrives in abundance, failed to reveal any mature fruits, although flowering spikes were plentiful. One of the most striking characteristics of this plant in the latter part of the season is its abundance of winter buds. In its morphological characters as well as its stem-anatomy this hybrid is intermediate between the supposed parents.

Explanation of Plates

Plate 746. Fruits of potamogeton (all × 5)

P. alpinus var. tenuifolius: fig. 1, Maine, *Fernald* 117; fig. 2, Newfoundland, *Kennedy* 81; fig. 3, Washington, *Suksdorf* 2172.

P. alpinus var. subellipticus: fig. 4, Maine, Sept. 5, 1894, *Fernald;* fig. 5, Quebec, *Fernald, Long & St. John* 6766 (type); fig. 6, New York, *House* 15182.

P. polygonifolius: figs. 7, 8, 9, Newfoundland, *Fernald & Wiegand* 4467.

P. amplifolius: fig. 10, Ohio, *Goodrich* 209; figs. 11 & 12, New York, *Muenscher & Maguire* 723 (12 with mesocarp removed); fig. 13, Ontario, Aug. 19, 1902, *Fowler*.

P. pulcher: fig. 14, Rhode Island, *Fernald, Long & Torrey* 8444; fig. 15, Massachusetts, July 1887, *Morong;* figs. 16, 17, Massachusetts, June 16, 1878, *C. E. Faxon* (17 with mesocarp removed).

P. nodosus: fig. 18, Minnesota, *Hotchkiss & Jones* 480; fig. 19, Connecticut, 1845, *Robbins;* fig. 20, Wisconsin, July 28, 1891; fig. 21, District of Columbia, Sept. 25, 1897, *Steele*.

P. natans: fig. 22, Ontario, *Ogden & Bolan* 1646; fig. 23, Minnesota, *Grant & Oosting* 3203; figs. 24, 25, New York, *Ogder & Bolan* 1580 (25 with mesocarp removed).

P. Oakesianus: fig. 26, Massachusetts, Aug. 28, 1851, *Robbins;* fig. 27, Quebec, *Fernald, Long & St. John* 6765; fig. 28, Nova Scotia, *Long & Linder* 19679; fig. 29, Michigan, *Pease & Ogden* 25135.

P. illinoensis: fig. 30, Iowa, July 21, 1882, *Cratty;* fig. 31, Illinois, Sept. 1881, *Patterson* (type); figs. 32, 33, Florida, *Curtiss* 6692; fig. 34, Indiana, *Lansing* 1079; fig. 35, New York, *R. Hitchcock* 11175a.

P. gramineus: fig. 36, Washington, *J. W. Thompson* 7589; fig. 37, Newfoundland, *Fernald & Long* 1210; fig. 38, Michigan, *Metcalf* 2187.

P. praelongus: figs. 39, 40, New York, *Muenscher & Maguire* 1747.

P. Richardsonii: fig. 41, Wisconsin, *Cheney* 4919; fig. 42, New York, Aug. 21, 1886, *Mororg;* fig. 43, Quebec, *Victorin* 18462; fig. 44, Michigan, 1863, *Robbins;* fig. 45, Washington, Aug. 1892, *Piper;* fig. 46, Montana, *Maguire* 497.

P. perfoliatus var. bupleuroides: fig. 47, Newfoundland, *Robinson & Schrenk* 207 (type); fig. 48, Maryland, *Coville* 118; fig. 49, Nova Scotia, *Graves & Linder* 19693; fig. 50, Quebec, *Fernald, Long & St. John* 6771 (mesocarp removed).

PLATE 747. POTAMOGETON NATANS: CROSS-SECTION OF STEM, × 35.

Camera-lucida drawing (cell-contents not shown) by *Francis T. Horne* from preparation by *Edith B. Ogden.*

PLATE 748. CAMERA-LUCIDA DRAWINGS (CELL-CONTENTS NOT SHOWN) FROM STEMS OF POTAMOGETON SHOWING TYPES OF STELES.

FIG. 1, P. AMPLIFOLIUS, × 40 (*Ogden & Marston* 1693); FIG. 2, P. PERFOLIATUS var. BUPLEUROIDES, × 75 (*Steinmetz* 526); FIG. 3, P. NODOSUS, × 75 (*Metcalf* 1105); FIG. 4, P. GRAMINEUS var. MAXIMUS, × 75 (*Ogden & Steinmetz* 1552); FIG. 5, P. GRAMINEUS var. TYPICUS, × 75 (*Ogden & Bolan* 1644); FIG. 6, P. BERCHTOLDI var. TENUISSIMUS × PERFOLIATUS var. BUPLEUROIDES (× *P. mysticus*), × 100 (*Ogden, Rollins & Wiggins* 1731).

LIST OF NUMBERED EXSICCATAE

Abrams, L. R. 6094, 8677 natans, 9241 amplifolius.

Adams, J. W. 293 amplifolius, 511 Oakesianus.

Adams & Tash. 512 crispus.

Adams & Trudell. 378 amplifolius.

Adrien, F. 1316 perfoliatus v. bupleuroides, 1442 illinoensis × nodosus, 1470, 1750 perfoliatus v. bupleuroides, 1758 Richardsonii, 1806 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii), 1809 nodosus, 1975 perfoliatus v. bupleuroides.

Alexander, C. P. 90 nodosus.

Allen, J. A. 55 pulcher, 149, 180, 181 gramineus.

Anderson, J. P. 20 gramineus approaching v. maximus, 21 natans, 838 Richardsonii, 1344 natans, 1522 Richardsonii.

Anderson, R. M. 118276 Richardsonii.

Anderson & Fassett. 19349 amplifolius.

Anderson, Smith & Weatherby 1166 natans.

Anselm, Bro. M. 18 natans, 20 gramineus v., 298 perfoliatus v. bupleuroides, 366, 376 praelongus.

Applegate, E. I. 741 gramineus approaching v. maximus, 742 natans, 3416 Richardsonii, 4489 natans.

Arsène, L. 38 pulcher, 40 perfoliatus v. bupleuroides, 41 polygonifolius, 43 perfoliatus v. bupleuroides.

Arsène & Benedict. 15429, 16636 nodosus.

Arthur, Bailey & Holway B46, B69, B403 gramineus v. maximus.

Austin, Mrs. R. M. 575, 1177 Richardsonii, 1672 natans.

Bailey, L. H. 86 natans.

Bailey, W. W. 1135 Richardsonii.

Baker, C. F. 427 illinoensis.

Ballard, C. A. 731½ gramineus approaching v. maximus.

Barkley, F. A. 1783 gramineus, 1996 gramineus v. myriophyllus, 1997 Richardsonii.

Baxter, M. S. 5382 praelongus, 5385 Richardsonii, 5388 crispus, 5389 nodosus, 5391 illinoensis, 5392 gramineus, 5395 natans, 5396 illinoensis, 5399 gramineus × illinoensis, 5402 illinoensis, 5403 amplifolius.

Bean & White. 19675 natans, 19696 perfoliatus v. bupleuroides, 22962 gramineus v. maximus, 22963 alpinus v. tenuifolius.

Bebb, R. 994 illinoensis, 995 natans, 1007 illinoensis (perhaps gramineus × illinoensis), 1008 natans, 1009 praelongus, 1538 illinoensis.

Beetle, A. A. 1462 Richardsonii, 2341 gramineus.

Bell, R. 2968 amplifolius.

Benson, L. 2824 natans, 4013 gramineus.

Bergman, H. F. 443 gramineus, 2484 amplifolius.

Berkley, E. E. 1215 crispus, 1387 amplifolius.

Bessey, E. A. B & D2781 alpinus v. tenuifolius.

Bicknell, E. P. 91 gramineus, 92 illinoensis, 112 Oakesianus, 118 perfoliatus v. bupleuroides, 122 praelongus.

Biltmore Herbarium. 688 Richardsonii, 4413a illinoensis, 5806a

nodosus, 5980a pulcher, 8806b nodosus.

Bissell, C. H. 633 natans.

Bissell & Linder. 19678 natans, 19692 gramineus, 19695 perfoliatus v. bupleuroides.

Blake, S. F. 2212 perfoliatus v. bupleuroides, 2216 gramineus × perfoliatus v. bupleuroides, 2308 Richardsonii, 3071 gramineus, 5483 perfoliatus v. bupleuroides, 9472 crispus.

Blakley, O. W. 1453 pulcher.

Blewitt, A. E. 632 amplifolius, 1677 perfoliatus v. bupleuroides, 1977 gramineus, 1978 perfoliatus v. bupleuroides, 2137 Richardsonii, 3651 perfoliatus v. bupleuroides, 3652 gramineus, 3657 nodosus, 4319, 4320 perfoliatus v. bupleuroides.

Bodin, J. E. 264 illinoensis.

Boettcher, F. L. J. 9 pulcher.

Boivin & Blain. 294 alpinus v. tenuifolius, 670 perfoliatus v. bupleuroides, 1344 alpinus v. tenuifolius approaching v. subellipticus, 2139 alpinus v. tenuifolius, 2446 alpinus v. subellipticus.

Bolander. 274 illinoensis.

Bowman, P. W. 303 gramineus, 392 Oakesianus.

Breed, Jeffrey, Jenkins, Loveless, Phillips, Stauffer & Stebbins 20 Richardsonii.

Brewer, W. H. 1783 gramineus, 1978 alpinus v. tenuifolius.

Bridges, T. 359 natans.

Brien, C. 306 nodosus.

Brinkman, A. H. 734 Richardsonii, 2277, 2289, gramineus, 4541 alpinus v. tenuifolius.

Brittain. 2987 gramineus v. maximus.

Brown, H. E. 644 natans.

Brown, S. 694 Richardsonii.

Burgess. 3029 natans.

Burkholder & Muenscher. 16404 amplifolius, 16424, 16425 Richardsonii.

Burkholder & Tressler. 16888 Richardsonii.

Burnham, S. H. 42 illinoensis.

Bush, B. F. 89 pulcher, 112 amplifolius, 1207 nodosus, 1318 amplifolius, 6947 illinoensis.

Butler, B. T. 251 gramineus, 255 Richardsonii, 257, 296 gramineus.

Butler, G. D. 142 Richardsonii.

Cain, R. F. 935 nodosus, 938 gramineus, 940 Richardsonii, 941 amplifolius, 972 praelongus, 978 illinoensis, 1030, 1031 amplifolius, 1043 gramineus v. maximus (perhaps gramineus × sp.), 1045 natans, 1049 Richardsonii, 1050 praelongus, 1051, 1052 Richardsonii.

Camp, S. H. 13 praelongus.

Carter, W. R. 337 gramineus v., 505 gramineus.

Chamberlain, E. B. 412 amplifolius, 616 perfoliatus v. bupleuroides, 617 natans, 913 perfoliatus v. bupleuroides, 943 natans, 1033 perfoliatus v. bupleuroides.

Chamberlain, G. D. 1750, 1770 gramineus, 2011 alpinus v. tenuifolius, 2123 perfoliatus v. bupleuroides, 2159 gramineus, 2240 praelongus, 2276 praelongus.

Chamberlain & Collins. 616 perfoliatus v. bupleuroides.

Chamberlain & Knowlton. 571 perfoliatus v. bupleuroides.

Chamberlain & Morris. 11741 Oakesianus.

Chase, Agnes. 1420 nodosus, 1421 Richardsonii, 1459 natans, 1466 praelongus, 1477 nodosus × Richardsonii, 1707 gramineus, 1710 amplifolius, 1713 gramineus × Richardsonii, 1994 nodosus × Richardsonii.

Cheney, L. S. 499 praelongus, 683 gramineus v. maximus, 866 Richardsonii, 1086 nodosus, 1420 natans, 1501 alpinus v. tenuifolius, 1735 amplifolius, 2097, 3576 Richardsonii, 3610 Oakesianus, 4919 Richardsonii, 4921 illinoensis.

Chitty, D. H. 204 gramineus, 260 natans, 261 gramineus, 265 gramineus × Richardsonii, 268, 269 gramineus (perhaps gramineus × perfoliatus v. bupleuroides), 306 Richardsonii, 319 amplifolius, 328 gramineus.

Clark, D. 2008 Richardsonii.

Clark, H. L. 6 Berchtoldi × perfoliatus v. bupleuroides.

Clark, H. W. 5 amplifolius, 6 illinoensis, 10 amplifolius.

Clements, F. 305, 2627 nodosus, 2979 amplifolius.

Clements, F. E. & E. S. 491 alpinus v. tenuifolius.

Cléonique. 7231 amplifolius.

Clinton, G. W. 5 gramineus v. maximus.
Clokey, I. W. 3118 alpinus v. tenuifolius.
Collins, F. S. 300 Oakesianus, 421 perfoliatus v. bupleuroides, 937 natans.
Collins, Fernald & Pease. 4013½, 5200, 5200A, 5287 gramineus, 5295 natans, 5314 gramineus, 5510 gramineus v., 5578 perfoliatus v. bupleuroides, 5911 alpinus v. subellipticus, 6050 alpinus v. subellipticus, 6125 gramineus.
Conard, H. S. 182 natans, 318 Richardsonii.
Cooper, W. S. 69 gramineus, 93 amplifolius, 94 gramineus v., 215 amplifolius, "254 in pt." alpinus v. tenuifolius, 260 natans, 312 praelongus.
Cooper & Andrews. 14 gramineus.
Copeland, E. B. 406 gramineus approaching v. maximus.
Copeland. 3482 gramineus approaching v. myriophyllus.
Corbett & Williams. 11 Richardsonii.
Cory, V. L. 8502 illinoensis, 9198 nodosus, 20906, 23819 illinoensis, 24332 nodosus, 24335, 27999 illinoensis, 29711 nodosus.
Cotton, J. S. 809 Richardsonii.
Coville, F. V. 114, 118 perfoliatus v. bupleuroides, 129, 189 amplifolius, 602 gramineus, 1254 praelongus.
Coville & Applegate. 44 gramineus approaching v. myriophyllus.
Coville & Funston. 1244, 1278 nodosus, 1693 gramineus.
Coville & Kearney. 385 gramineus, 1564 alpinus v. tenuifolius.
Coville & Leiberg. 224, 228 natans.
Cowles, H. C. 1405 natans.
Crandall, C. S. 2530 nodosus.
Crickmay, C. H. 5 Richardsonii.
Curtiss, A. H. 4, 6692 illinoensis.
Cushman, J. A. 1766 natans, 6007 nodosus, 6009 Richardsonii, 6010 gramineus, 6825 gramineus v. maximus.
Cusick, W. C. 2484 praelongus, 2597 natans, 3620 Richardsonii.
Daniels, F. 683 nodosus.
Darlington, H. T. 1311 illinoensis, 1323, B & D2401, B & D2692 Richardsonii.
Davis, R. J. 378-W praelongus.
Dawson, G. M. 3046 Richardsonii.
Deam, C. C. 25704 pulcher, 31302 gramineus × illinoensis, 31591 gramineus, 38978 nodosus, 48466 amplifolius, 49019 natans, 49042 illinoensis, 49205 gramineus × illinoensis, 49248 illinoensis, 49268 natans, 49274, 49285, 49312 illinoensis, 49314 amplifolius, 49315 gramineus × illinoensis, 49347, 49355 illinoensis, 49360 natans, 49363, 49369, 49372, 49389 illinoensis, 49391 natans, 49394 praelongus, 49395 illinoensis, 49399 amplifolius, 49402, 49417 illinoensis, 52273 amplifolius, 52334 natans, 52341 illinoensis, 52385 nodosus, 52425 amplifolius, 52437 natans, 54236, 54462 illinoensis, 55176 nodosus, 55313 amplifolius, 55350, 55410 illinoensis, 56274A Richardsonii, 56396 illinoensis, 56398 praelongus, 56401, 56441, 56448 illinoensis, 56490 amplifolius, 56498, 56501 illinoensis, 56502 amplifolius, 56524 gramineus × illinoensis, 56534 amplifolius, 56537 gramineus × illinoensis, 56538, 56539 illinoensis, 56541 natans, 56545 illinoensis, 56546 natans, 56547, 56568 illinoensis, 56607 crispus, 56616 amplifolius, 56680, 56682 illinoensis, 56683 amplifolius, 56686 Richardsonii, 56687 illinoensis, 56692, 56704, 56783 nodosus, 57139 praelongus, 57149 natans, 57195 illinoensis, 57259 gramineus.
Dean & Thomas. 3465 Richardsonii.
Delamare, M. 341 perfoliatus approaching v. bupleuroides.
Demaree, D. 7051, 7132, 17893 nodosus.
De Selm, A. W. 22 gramineus v. myriophyllus, 24 amplifolius and natans.
Dobbin, F. 860 Richardsonii, 863 perfoliatus v. bupleuroides, 1072 Richardsonii, 1112 illinoensis, 1186 amplifolius, 1207 nodosus, 1209 illinoensis, 1327 Richardsonii, 1328, 1330 natans.
Dodge, C. K. 4 Richardsonii, 7 illinoensis, 8 gramineus, 115 natans, 122 Richardsonii, 131 gramineus, 133 illinoensis and Richardsonii, 146 Richardsonii, 147 gramineus,

153 gramineus v. maximus and gramineus approaching v. maximus, 154 perhaps gramineus × illinoensis, 155 gramineus v. maximus, 156 natans, 171 illinoensis, 172 amplifolius, 384 gramineus, 1037, 1038 Richardsonii.

Doutt, M. T. 2145, 2258 Richardsonii, 2490 praelongus, 3296 alpinus v. tenuifolius, 3323 Richardsonii.

Dowell & Painter 5385 nodosus.

Driggs, A. W. 40 nodosus.

Drouet, F. 3028 nodosus.

Drouet & Richards. 3309 gramineus.

Drummond, T. 250 nodosus, 272 illinoensis.

Drushel, J. H. 6069 perfoliatus v. bupleuroides.

Dubois, A. 660 perfoliatus v. bupleuroides.

Dudley, W. R. 18, 19 natans, 20 illinoensis, 2030 natans, 2201 alpinus v. tenuifolius, 2202 natans.

Eames, A. J. 1498 gramineus, 1500 gramineus × perfoliatus v. bupleuroides, 3460 nodosus, 3467 crispus, 9099 gramineus.

Eames, E. H. 8707 illinoensis, 8746 pulcher, 9590 praelongus × sp., 11351 illinoensis, 11485, 11502 crispus, 11733 gramineus × perfoliatus v. bupleuroides, 11741 perhaps gramineus × perfoliatus v. bupleuroides, 11742 illinoensis, 11745 gramineus v. maximus, 11749, 11750 illinoensis, 11856 crispus.

Eames & Gershoy. 9101 Richardsonii.

Eames & Godfrey. 8685 praelongus, 9334 alpinus v. subellipticus.

Eames & MacDaniels. 3463 gramineus × illinoensis.

Eames, Randolph & Wiegand. 11175 illinoensis, 11181 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii).

Eames & Thomas. 3459 nodosus.

Eames & Wiegand. 9100 Richardsonii, 9102 perfoliatus v. bupleuroides, 11162 natans, 11172 amplifolius, 11173 gramineus, 11179 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii), 14535 crispus.

Eaton, A. A. 335 illinoensis.

Edwards & Clausen. 1400 perfoliatus v. bupleuroides.

Eggleston, W. W. 1 nodosus, 1655 amplifolius, 1656 alpinus v. subellipticus, 2111 Oakesianus, 9974 Richardsonii.

Ehlers, J. H. 533, 1756, 7957 praelongus.

Elmer, A. D. E. 2798 amplifolius.

Emig, W. H. 224 nodosus.

Empain, Rousseau & Noreau. 50925 Richardsonii.

Evans, W. H. 780 gramineus v. maximus, 781 natans.

Evermann, B. W. 490 perhaps illinoensis × nodosus, 492 Richardsonii, 493 amplifolius, 544a perhaps gramineus × illinoensis, 1032 natans, 1057 Richardsonii, 1079 illinoensis, 1221 gramineus, 1222 illinoensis, 1223 amplifolius.

Eyerdam, W. J. 1122 praleongus, 1143 gramineus, 1316 gramineus × sp., 2141 alpinus v. tenuifolius, 2156 Richardsonii, 2360 alpinus v. tenuifolius.

Farwell, O. A. 473 gramineus, 473a gramineus × Richardsonii, 505 natans, 514 alpinus v. subellipticus, 900 illinoensis.

Fassett, N. C. 8 gramineus v., 85, 456 perfoliatus v. bupleuroides, 468 amplifolius, 2148 perfoliatus v. bupleuroides, 2150, 2151 gramineus × perfoliatus v. bupleuroides, 2152 perfoliatus v. bupleuroides (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 62 & 127), 3148, 4350 nodosus, 5343 alpinus v. tenuifolius, 5362 amplifolius, 7535 Richardsonii, 9014 praelongus, 9061 Richardsonii, 9067, 9069 gramineus, 14262 gramineus, v. myriophyllus, 14746 crispus, 18731 illinoensis, 18803 Oakesianus.

Fassett & Wilson. 4349 nodosus.

Fellows, D. W. 2006 amplifolius, 2007 Richardsonii, 2966, 4679 perfoliatus v. bupleuroides, 4887 Richardsonii, 5656 gramineus × sp.

Fendler, A. 132 amplifolius, 837, 839 nodosus.

Fernald, M. L. 116 gramineus approaching v. maximus, 117 alpinus v. tenuifolius, 436 gramineus v. maximus, 440 gramineus × perfoliatus v. bupleuroides, 475 natans, 477 gramineus v. maximus,

509 Oakesianus, 750 pulcher, 778 natans, 1609 gramineus × perfoliatus v. bupleuroides, 1610, 1611, 1612 perfoliatus v. bupleuroides, 1614 amplifolius, 1619 gramineus, 1622 alpinus v. tenuifolius, 2756 natans, 2767 gramineus v. maximus, 8439, 15965 Oakesianus.

Fernald & Abbe. 2506 amplifolius.

Fernald, Bartram & Long. 23129 natans, 23131 Oakesianus, 23141 gramineus v. maximus.

Fernald, Bartram, Long & Fassett. 23139 amplifolius.

Fernald, Bartram, Long & St. John. 6764 Oakesianus, 6769 perfoliatus v. bupleuroides.

Fernald, Bissell, Graves, Long & Linder. 19689 amplifolius.

Fernald & Collins. 327 alpinus v. subellipticus, 965 alpinus v. tenuifolius.

Fernald, Dodge & Smith. 25421 perfoliatus, 25422, 25423, 25424 praelongus.

Fernald & Fogg. 505, 747 Oakesianus.

Fernald, Gilbert & Hotchkiss. 27346 praelongus.

Fernald & Griscom. 4295 pulcher.

Fernald, Griscom & Long. 4535 pulcher.

Fernald, Hunnewell & Long. 8443 pulcher, 8445 perfoliatus v. bupleuroides.

Fernald & Jackson. 11986 natans, 11987 alpinus v. tenuifolius, 11988 gramineus, 11989 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii).

Fernald & Linder. 19682 Oakesianus.

Fernald & Long. 1210 gramineus, 5977 pulcher, 7747 crispus, 8440, 8441 Oakesianus, 8442, 8538 pulcher, 9799 crispus, 10089 pulcher, 10873 perfoliatus v. bupleuroides, 12229 pulcher, 12230 epihydrus v. Nuttallii × pulcher, 12381 natans, 12386 alpinus v. tenuifolius, 12387 alpinus v. subellipticus, 12388 alpinus v. tenuifolius, 12389 nodosus, 12391, 12392 perfoliatus v. bupleuroides, 13216 pulcher, 15967 perfoliatus v. bupleuroides, 17805 Oakesianus, 17807 perfoliatus v. bupleuroides, 19677 natans, 19687 alpinus v. subellipticus, 19688 amplifolius, 19690 gramineus, 19694 perfoliatus v. bupleuroides, 23130 natans, 23132 Oakesianus, 23137, 23138 pulcher, 23140 amplifolius, 23142 gramineus approaching v. maximus, 23143 perfoliatus v. bupleuroides, 27344 gramineus v., 27345 gramineus, 27347 praelongus.

Fernald, Long & Dunbar. 26217 Oakesianus, 26218 polygonifolius, 26221 alpinus v. subellipticus, 26222 perhaps gramineus × perfoliatus v. bupleuroides, 26223 praelongus.

Fernald, Long & Fogg. 1207 alpinus v. tenuifolius, 1208 Oakesianus, 1209 gramineus v. maximus, 1211 praelongus, 1212 perfoliatus v. bupleuroides.

Fernald, Long & Norton. 12382 natans, 12383, 12384 Oakesianus.

Fernald, Long & St. John. 6763 natans, 6765 Oakesianus, 6766 alpinus v. subellipticus, 6767, 6768 praelongus, 6770, 6771 perfoliatus v. bupleuroides.

Fernald, Long & Torrey. 8444 pulcher.

Fernald & Pease. 3066 Oakesianus, 16957, 17056 gramineus, 19676 natans.

Fernald & St. John. 10894 natans.

Fernald & Smith. 25420 alpinus v. subellipticus.

Fernald & Strong. 477 gramineus v. maximus.

Fernald & Svenson. 744 gramineus v. myriophyllus, 745 natans, 748 Oakesianus, 749 praelongus, 751 perfoliatus v. bupleuroides.

Fernald & White. 19680 Oakesianus.

Fernald & Wiegand. 2435 natans, 2436 Oakesianus, 2443 alpinus v. tenuifolius approaching v. subellipticus, 2444 praelongus, 2448 gramineus, 2449 gramineus v. maximus, 2450 perfoliatus, 4466 Oakesianus, 4467, 4468 polygonifolius, 4473 alpinus v. tenuifolius, 4478, 4479 gramineus, 4483, 4484, 4485 perfoliatus v. bupleuroides, 14533 illinoensis.

Fernald, Wiegand & Bartram. 4463 Oakesianus.

Fernald, Wiegand, Bartram & Darlington. 4477 gramineus v. maximus.

Fernald, Wiegand & Darlington.

4461, 4462 natans, 4464, 4465 Oakesianus, 4474 alpinus v. tenuifolius, 4475 gramineus v. maximus, 4476 gramineus, 4480 gramineus v. maximus, 4481 gramineus, 4482 praelongus.

Fernald, Wiegand & Eames. 14082 alpinus v. tenuifolius, 14084, 14085 gramineus, 14086 amplifolius, 14087 Richardsonii, 14088 Richardsonii and perfoliatus v. bupleuroides, 14089 crispus.

Fernald, Wiegand & Kittredge 2437 Oakesianus, 2441 praelongus, 2442 alpinus v. subellipticus, 2445, 2446, 2447 gramineus, 2451 perfoliatus v. bupleuroides.

Fernald, Wiegand & Long. 27348 perfoliatus.

Fernald, Wiegand, Long, Gilbert & Hotchkiss. 27341, 27342 gramineus × perfoliatus v. bupleuroides (probably backcrossed with gramineus)

Ferris, Roxana S. 2043 natans, 8845 amplifolius.

Fiker, C. B. 1455 natans.

Fink, B. 191 illinoensis.

Fitch, A. 7778 natans.

Fletcher. 2969 amplifolius, 3025, 3028 natans, 3044 Richardsonii.

Fogg, J. M. 710, 1840, 2077, 2997, 3505 pulcher, 3606 perfoliatus v. bupleuroides, 3867 Oakesianus, 4504 pulcher, 4934 amplifolius, 4935 praelongus, 6794 nodosus, 12254 crispus.

Forbes, F. F. 156 perfoliatus v. bupleuroides and gramineus × perfoliatus v. bupleuroides.

Foster, A. S. 866 natans, 1992 amplifolius.

Fredholm, A. 6183 illinoensis.

Fulton, H. J. 9703 nodosus.

Garrett, A. O. 529 alpinus v. tenuifolius approaching v. subellipticus, 3958 nodosus.

Gates, F. C. 258 Richardsonii, 261 praelongus, 1752.2 natans, 10540 praelongus, 10644 illinoensis, 12217 natans.

Gauthier, R. 100 amplifolius, 135 perfoliatus v. bupleuroides, 2422 amplifolius.

Gillman, H. 40 Richardsonii (perhaps Richardsonii × sp.), 65 Richardsonii, 67 illinoensis.

Glatfelter, Herbarium of N. M. 561 amplifolius, 562 Richardsonii.

Gleason, H. A. & H. A. Jr. 166 natans, 302, 310 gramineus.

Gleason & Shobe. 176 amplifolius, 179 natans.

Glendenning, R. 92616, 92617 gramineus, 92618 Richardsonii.

Goldman, E. A. 2453 natans.

Goodale, Markert & Piper. 76938, 76945, 76947 natans, 76948, 76951 Oakesianus, 76973 gramineus, 96988 pulcher.

Goodding, L. N. 539 nodosus.

Goodman, B. B. 16287 nodosus.

Goodman & Hitchcock. 1803 illinoensis (perhaps gramineus × illinoensis).

Goodrich, Sara F. 207 Richardsonii, 209 amplifolius.

Gorman, M. W. 233, 677 Richardsonii, 703 illinoensis, 781 Richardsonii.

Graham, E. H. 9821 nodosus.

Grant, M. L. 3029 praelongus.

Grant & Oosting. 3184 illinoensis, 3203 natans, 3206 Richardsonii, 3207 illinoensis, 3272 gramineus, 3275 amplifolius, 3276 gramineus.

Graves & Linder. 19681 Oakesianus, 19691 gramineus × perfoliatus v. bupleuroides (perhaps backcrossed with gramineus), 19693 perfoliatus v. bupleuroides.

Griffin, D. B. 1 illinoensis.

Griffiths, D. 6 Richardsonii.

Griffiths & Schlosser. 4 amplifolius.

Grimes, E. J. 594 nodosus, 3255 crispus, 4196 pulcher.

Griscom & Mackenzie. 10679 amplifolius, 10680 perfoliatus v. bupleuroides, 10681 praelongus, 10685 natans, 10686 gramineus.

Hall, E. 486 natans, 487 (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 115 & 129), 488, 488a amplifolius, 489, 490 Richardsonii.

Hall & Chandler. 563 alpinus v. tenuifolius.

Hamilton. 64010 alpinus v. tenuifolius.

Hanes, C. R. 327 nodosus, 367, 377, 397, 477 gramineus × sp., 487, 497 illinoensis, 507 gramineus × sp., 517 illinoensis, 757 amplifolius, 1928 Oakesianus and epihydrus v. Nuttallii, 1978, 1988 natans.

Harper, F. 74 gramineus v. maxi-

mus (perhaps gramineus × alpinus), 98, 141 Richardsonii.

Harper, R. M. 24 illinoensis (not typical), 1402, 2088 pulcher.

Harrington, W. H. 2441 perfoliatus v. bupleuroides, 99085 gramineus, 99086 gramineus v. maximus, 99088 perfoliatus v. bupleuroides, 99089, 99090 Richardsonii, 99091 perfoliatus v. bupleuroides, 99092 natans, 99099 perhaps gramineus × illinoensis, 99100 perhaps alpinus × gramineus, 99101 nodosus, 99102 gramineus v. maximus.

Harris, S. K. 539 praelongus, 540 perfoliatus v. bupleuroides.

Harrison, A. K. 15 natans, 16 illinoensis.

Hartweg, T. 2016 nodosus (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 66 & 130), 2017 nodosus.

Hawkins, P. H. 650 Richardsonii.

Hay, G. U. 2989 gramineus, 4131 praelongus.

Hayden, Ada. 751 Richardsonii, 752 nodosus, 804 Richardsonii, 806 nodosus, 807 illinoensis, 811 Richardsonii, 821 gramineus, 823 natans, 10112 nodosus, 10113 Richardsonii, 10114, 10115, 10116, 10117, 10123, 10129 nodosus.

Haydon, W. 254 natans.

Heller, A. A. 939 natans, 5824 nodosus.

Henderson, L. F. 1007 natans, 1009 Richardsonii, 2473 illinoensis, 2474 amplifolius, 2475 illinoensis, 2477 gramineus v., 2717 natans, 4882 nodosus.

Hermann, F. J. 5781 gramineus, 6281 praelongus, 7153, 7224 Richardsonii, 7230 gramineus, 8234 praelongus, 8286 gramineus, 8647 crispus, 9294 gramineus × illinoensis, 9383, 9728 nodosus.

Herriot, W. 78019, 78020 gramineus.

Hill, A. F. 1222, 1513 Oakesianus, 2341 perfoliatus v. bupleuroides, 2560 Oakesianus, 2560a natans.

Hill, E. J. 46.1884 pulcher, 92.1888 alpinus v. subellipticus, 133.1881 gramineus × Richardsonii, 151.1901, 159.1909 nodosus, 162.1900 illinoensis, 171.1900, 179.1901, 191.1902 nodosus × Richardsonii.

Hitchcock, A. E. 260 gramineus, 444, 1034 nodosus.

Hitchcock, A. S. 1000, 1099 amplifolius, 12358 natans, 15655 nodosus.

Hitchcock, R. 11167, 11168 nodosus, 11175a illinoensis.

Hodgdon, A. R. 11 perfoliatus v. bupleuroides, 530 nodosus, 2640 natans, 2647 perfoliatus v. bupleuroides, 2652 amplifolius.

Hodgdon & Healey. 2977 natans.

Hodgdon, Jones, Nolan & Harrington. 3378 amplifolius.

Holway, E. W. D. 40 Richardsonii.

Hotchkiss, N. 75 alpinus v. tenuifolius approaching v. subellipticus, 2646 amplifolius, 2731 gramineus (perhaps gramineus × illinoensis), 27338 alpinus v. subellipticus.

Hotchkiss & Jones. 417 gramineus, 480 nodosus, 3928 praelongus, 3976, 4003 Richardsonii, 4033 illinoensis, 4058 Richardsonii, 4059 gramineus, 4060 praelongus, 4083 gramineus, 4109 nodosus, 4110 natans, 4112 gramineus, 4133 illinoensis.

Hotchkiss & Koehler. 4179 illinoensis, 4192 amplifolius, 4193 natans, 4194 gramineus, 4222, 4223, 4226, 4227 illinoensis, 4228 praelongus, 4245 illinoensis, 4246 praelongus, 4262, 4304 illinoensis, 4307 gramineus, 4326, 4331 illinoensis, 4340 praelongus, 4349 alpinus v. subellipticus, 4353 amplifolius.

Hotchkiss & Martin. 4432 illinoensis, 4460 alpinus v. subellipticus.

House, H. D. 517 nodosus, 1329 amplifolius, 1338, 5044 natans, 6053 amplifolius, 7244 natans, 8220 Richardsonii, 8838 amplifolius, 10069 crispus, 10070 praelongus, 15182 alpinus v. subellipticus, 15193 gramineus, 16979 natans, 19852, 20002 nodosus, 21752 amplifolius, 21774, 22044 nodosus, 23174 gramineus.

Howe & Lang. 768 natans, 1040 gramineus.

Howell, J. T. 7679 Richardsonii.

Howell, T. J. 364 Richardsonii, 365 natans, 1496 Richardsonii, 1497 nodosus × Richardsonii, 1498 amplifolius, 1668 gramineus.

Hultén, E. 7573 alpinus v. tenuifolius.

Hylan, D. R. 79 natans.
Innes & Moon. 1093 nodosus.
Jackson, H. H. T. 52 gramineus × illinoensis.
Jepson, W. L. 147 alpinus v. tenuifolius, 238 Richardsonii.
Jesup, H. G. 4 gramineus approaching v. myriophyllus.
Johnson, H. N. 2719 nodosus, 2725 perfoliatus v. bupleuroides.
Johnston, I. M. 6001 illinoensis.
Jones, G. N. 3511 illinoensis, 3889 alpinus v. tenuifolius, 5227, 7851 gramineus.
Jones, M. E. 734, 1297 alpinus v. tenuifolius, 1304 gramineus v. maximus, 2310 nodosus, 5788 Richardsonii, 6023 praelongus, 6606 alpinus v. tenuifolius, 9293, 9295 gramineus, 9299 Richardsonii.
Jones, R. N. 7465 illinoensis, 7470, 7471 crispus.
Jones, W. W. 432 nodosus.
Jones & Hoffman. 7467 Richardsonii.
Jones & Wiegand. 7462 illinoensis.
Kearney, T. H. 74 nodosus, 1626 pulcher.
Keck, D. D. 1188 natans.
Keck & Stevens. 280 illinoensis, 323 Richardsonii, 332 amplifolius, 335 crispus.
Keck & Stilwill. 368 natans, 373 gramineus, 377 amplifolius, 379 gramineus, 401 nodosus, 402 natans, 412 praelongus, 428, 430 crispus, 433 amplifolius, 454 gramineus, 455 praelongus, 458 Richardsonii.
Kellogg & Harford. 949 illinoensis.
Kelsey & Jordan. 8 gramineus, 9 perfoliatus.
Kendall, Goldsborough & Doolittle. 12 amplifolius, 17 praelongus, 22 gramineus, 111 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides × Richardsonii).
Kennedy, Rachel B. 78 gramineus × perfoliatus v. bupleuroides, 80 natans, 81 alpinus v. tenuifolius, 82, 405 gramineus, 478 perfoliatus v. bupleuroides, 543 Oakesianus, 551 perfoliatus v. bupleuroides.
Kenoyer, L. A. 136 illinoensis (perhaps gramineus × illinoensis), 139 praelongus.
Killip, E. P. 931 amplifolius, 6203 Richardsonii, 6204 natans, 6896 pulcher, 12258 natans, 12261 amplifolius, 12264 illinoensis × perfoliatus v. bupleuroides, 12265 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii), 12266 gramineus (perhaps gramineus × illinoensis), 12487 natans and amplifolius, 12535 nodosus, 12574 Oakesianus and epihydrus v. Nuttallii, 12605 alpinus v. subellipticus and amplifolius, 12610 amplifolius, 13379 Oakesianus, 30845 pulcher.
Kimball, R. H. 70 Oakesianus.
Kindle, E. M. 93540, 93572 gramineus, 93584 natans.
Knowlton, F. H. 288 natans.
Knowlton & Weatherby. 6632 Oakesianus.
Kreager, F. O. 441 amplifolius.
Krotkov, P. V. 5142 alpinus v. tenuifolius approaching v. subellipticus and epihydrus v. Nuttallii, 5144 gramineus, 5145 gramineus v., 5147 natans, 5150 praelongus, 7027 illinoensis, 7033, 7034, 7035, 7036 gramineus, 7038 natans, 7041 Richardsonii, 8629 amplifolius, 8633 natans.
Kubichek, W. F. 7 natans, 13 gramineus, 17, 64 Richardsonii, 66 gramineus, 71, 72 illinoensis, 78 gramineus, 79 natans, 101 gramineus, 109 Richardsonii, 110, 114, 115 illinoensis, 115b amplifolius and natans, 120 amplifolius, 121, 123 illinoensis, 132 gramineus v., 142 gramineus, 147, 148, 149 nodosus, 172 gramineus, 173, 184 illinoensis, 190 natans, 192 gramineus, 196 illinoensis.
Kuntze, Herbarium of Otto. 3105 perhaps gramineus × illinoensis.
Laing, H. M. 147 Richardsonii.
Lake, E. R. 614 gramineus.
Lakela, Olga. 2731 gramineus.
Lambert, Bertha B. 1 amplifolius.
Lansing, O. E. 1059 nodosus, 1079, 1779 illinoensis, 4274 natans.
Lawton, Amy C. 50 nodosus, 53 Richardsonii.
Leiberg, J. B. 751 gramineus, 1574 Richardsonii.
Leonard & Killip. 603 nodosus, 863 perfoliatus v. bupleuroides.
Leonard & Mannakee. 5489 amplifolius.
Lewis, H. F. 130388 natans, 130390, 130391, 130393 alpinus v.

tenuifolius, 130394, 130395, 130396 gramineus, 130397 perfoliatus.

Lindheimer, F. 116, 311, 393 nodosus, 513, 547 illinoensis, 1234 nodosus.

Linsdale & Keck. 1 gramineus, 54 amplifolius, 59 illinoensis, 115 amplifolius, 127 natans, 153 praelongus.

Long, C. A. E. 937 natans, 1012 gramineus.

Long & Linder. 19679 Oakesianus.

Looff, Ethel H. & H. B. 1501 alpinus v. tenuifolius.

Lorenzo. 35771 natans.

Louis-Marie, R. 313 alpinus v. tenuifolius, 1255 nodosus.

Louis-Marie, Laporte & Dudemaine. 301 gramineus × perfoliatus v. bupleuroides, 302 gramineus, 501 Richardsonii, 1403 gramineus, 1525 perfoliatus.

Lucien. 20458 amplifolius.

Lucy, T. F. 424 nodosus, 10814 crispus, 10816 nodosus, 10841, 10842 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides × Richardsonii), 10843 gramineus × perfoliatus v. bupleuroides.

Lunell, J. 150 gramineus.

Mabbott, D. C. 251, 252, 317, 334, 350, 390 Richardsonii, 459 natans, 500 Richardsonii.

McAtee, W. L. 977 nodosus, 1060 perfoliatus v. bupleuroides, 1707 illinoensis, 2279, 2337 amplifolius, 2374 nodosus, 2953 crispus, 3074, 3076 gramineus, 3078 natans, 3082 illinoensis, 3201a, 3205 Oakesianus, 3409 illinoensis, 3420 gramineus.

McCabe, T. T. 43 alpinus v. tenuifolius, 47 natans.

McCalla, W. C. 2370 Richardsonii.

MacDaniels, L. H. 3464 illinoensis.

MacDougal, D. T. 44 Richardsonii, 80 gramineus approaching v. maximus, 240 natans, 241 gramineus, 302 Richardsonii, 303 amplifolius, 304 gramineus × illinoensis, 462 natans, 543 nodosus, 571 alpinus v. tenuifolius, 638 gramineus approaching v. maximus, 639 gramineus, 676 natans, 805, 956 Richardsonii.

McKay. 4129 praelongus.

Mackenzie, K. K. 293 illinoensis, 359 pulcher, 2305 amplifolius, 3613 gramineus v. maximus, 4377 natans.

Mackenzie & Griscom. 10043 natans, 10044 Oakesianus, 10045 amplifolius, 10047 alpinus v. subellipticus, 10048 gramineus, 10048a gramineus approaching v. maximus, 10049 perfoliatus v. bupleuroides.

McLouth, C. D. 4 illinoensis.

MacMillan & Sheldon. 488 gramineus, 571 Richardsonii, 1332 gramineus v. maximus.

McMurphy, J. 192 nodosus, 193 natans.

Macoun, J. M. 2975 gramineus, 2979 gramineus × perfoliatus v. bupleuroides, 2980, 2984, 2992 gramineus, 3020, 3021, 3022, 3026 natans, 3045 Richardsonii, 3047 Richardsonii (perhaps Richardsonii × sp.), 3049, 3052, 3054, 3055, 3056 Richardsonii, 4162, 4165 alpinus v. tenuifolius, 4166 alpinus v. subellipticus, 4178 gramineus × sp., 4358 natans, 4362 gramineus v. maximus, 4368, 4381 Richardsonii, 26814 natans, 26815 illinoensis (perhaps a hybrid), 26816 gramineus × Richardsonii, 26817 Richardsonii, 80929, 83118 gramineus, 86002 amplifolius.

Macoun, John. 8 natans, 9 praelongus, 14 illinoensis (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 55 & 131), 94 alpinus v. tenuifolius, 95 Richardsonii, 96 gramineus, 97 gramineus v. maximus, 98 gramineus approaching v. maximus, 1730 amplifolius, 1733 gramineus approaching v. maximus, 1740 Richardsonii and perfoliatus v. bupleuroides, 2967 amplifolius, 2970 nodosus, 2971 natans and epihydrus v. Nuttallii, 2972, 2974, 2977 gramineus, 2978 gramineus v. maximus, 2981, 2982, 2982a gramineus, 2983, 2986 gramineus × perfoliatus v. bupleuroides, 2991 gramineus, 2993 Oakesianus, 2995, 2996 illinoensis, 3019 natans, 3023 illinoensis, 3024, 3027 natans, 3043 perfoliatus v. bupleuroides, 3048 Richardsonii, 3053, 3057 Richardsonii, 4128, 4130, 4132, 4132a praelongus, 4163, 4165, 4167, 4167a alpinus v. tenuifolius, 4168, 4169 alpinus v. subellipticus, 4177 illinoensis, 4179 gramineus × Richardsonii, 4180 illinoensis, 4357 natans, 4360 gramineus

v. maximus × nodosus, 4364 amplifolius, 4365 alpinus v. tenuifolius, 4379, 4380, 4382 Richardsonii, 8006 alpinus v. tenuifolius, 16441 gramineus, 16458, 16459, 16460, 16461 Richardsonii, 20748, 20749 Oakesianus, 20751 alpinus v. subellipticus approaching v. tenuifolius, 20756 perfoliatus v. bupleuroides, 22176 Richardsonii, 22177 nodosus, 22211, 22212 natans, 22216, 22217 gramineus, 22220 perhaps alpinus × gramineus, 22221 amplifolius, 22227 perfoliatus v. bupleuroides, 22228, 22229 amplifolius, 23173, 23175 Richardsonii, 23180 gramineus, 26824, 26826 Richardsonii, 26830 crispus, 26832, 26833 Richardsonii, 26834 amplifolius, 26839 nodosus, 26840 natans, 26841, 62015, 62016 nodosus, 62021 illinoensis, 62022 natans, 62023, 62024 gramineus, 68425 natans, 68919, 78320, 78321 alpinus v. tenuifolius, 85530 natans, 85531 perhaps alpinus × gramineus, 85534 amplifolius, 85535, 85536 gramineus v. maximus, 85537 Richardsonii, 85550 nodosus, 88248, 88249, 88250, 88251 natans, 88252 amplifolius, 88253 gramineus v. maximus, 88254, 88255 gramineus, 88256 gramineus approaching v. maximus, 88257, 88258, 88259 praelongus.

Macoun & Herriot. 76868 gramineus, 76869 gramineus v. maximus, 76870, 76871, 76872 Richardsonii.

Maguire, B. 472 alpinus v. tenuifolius, 473 alpinus v. subellipticus, 474 alpinus v. tenuifolius, 483, 484 gramineus, 485, 486 praelongus, 488, 490, 491, 495, 496, 497 Richardsonii, 13149 gramineus v. maximus, 16201 Richardsonii, 16220 gramineus v. maximus, 1636 Richardsonii.

Maguire & Piranian. 5439 natans, 5440 Richardsonii, 5442 alpinus v. tenuifolius.

Maguire, Piranian & Richards. 12771 gramineus v. maximus.

Maguire & Richards. 13156 alpinus v. tenuifolius.

Maguire, Richards, Maguire & Hammond. 4367 illinoensis.

Malte, M. O. 118247, 118248, 118249 perfoliatus v. bupleuroides, 118250, 118251, 118252 Richardsonii, 118257 gramineus, 118258 perhaps gramineus × illinoensis, 118259, 118260, 118261, 118262 perhaps alpinus × gramineus, 118263, 118264 gramineus v. maximus, 118265 gramineus, 118266 gramineus v. maximus, 118267, 118268 amplifolius, 118269, 118270 natans, 118273, 118274, 118275 nodosus.

Malte & Watson. 960, 1276, 1818 Richardsonii.

Markert, W. C. 76909 perfoliatus v. bupleuroides.

Martin, A. C. 158 natans.

Martindale, I. C. 12003 amplifolius.

Mathias, Mildred E. 265 natans.

Maxon, William R. 4617 Richardsonii.

Mearns, E. A. 805 nodosus.

Merrill & Wilcox. 863 Richardsonii, 902 gramineus.

Mertie, J. B. 66 Richardsonii.

Metcalf, F. P. 8 illinoensis, 9 Richardsonii, 14 praelongus, 50 natans, 193, 304, 322, 339 Richardsonii, 345, 355 gramineus, 404 Richardsonii, 423 gramineus, 432, 451 Richardsonii, 471 gramineus, 512 Richardsonii, 522 praelongus, 542 Richardsonii, 544 natans, 546 praelongus, 547 Richardsonii, 636, 819, 842, 845 nodosus, 888, 929 amplifolius, 948 crispus, 1018, 1024 nodosus, 1055 illinoensis × nodosus, 1071, 1105 nodosus, 1139 natans, 1140 amplifolius, 1145 Richardsonii, 1147 praelongus, 1160 amplifolius, 1162 gramineus, 1176 Richardsonii, 1229 praelongus, 1291 pulcher, 1295 natans, 1297, 1298, 1329, 1370 illinoensis, 1373 gramineus, 1379, 1383 illinoensis, 1388 natans, 1390 Richardsonii, 1391 illinoensis, 1412 gramineus, 1413 praelongus, 1415 gramineus v., 1420, 1427 illinoensis, 1428 gramineus, 1432 illinoensis, 1463 Richardsonii, 1464 gramineus, 1470 illinoensis, 1471 nodosus, 1472 gramineus, 1511 amplifolius, 1520 gramineus, 1532 gramineus × illinoensis, 1542, 1543, 1551, 1563, 1564 illinoensis, 1780, 1794, 1839, 1908, 1937 Richardsonii, 1962 natans, 1963, 1979, 1991 Richard-

sonii, 2014 illinoensis, 2024 amplifolius, 2039 illinoensis, 2044 Richardsonii, 2046 nodosus, 2048 illinoensis, 2049 natans, 2050 gramineus, 2055 illinoensis, 2065 natans, 2076 illinoensis, 2093 praelongus, 2105 gramineus, 2107 illinoensis, 2113 natans, 2124 Richardsonii, 2132 praelongus, 2147 illinoensis, 2187 gramineus, 2201 natans, 2209, 2210 amplifolius, 2211 natans, 2226 Richardsonii, 2242, 2250 amplifolius, 2251, 2252 illinoensis, 2253 gramineus × illinoensis, 2254, 2255 amplifolius, 2256 gramineus × illinoensis, 2259 gramineus, 2291 praelongus, 2302 natans, 2311 perhaps praelongus × sp., 2316 praelongus, 2317 illinoensis, 2318 gramineus, 2321 amplifolius, 2324, 2326 gramineus, 2340 Richardsonii, 2341 illinoensis, 2342 natans, 2345 illinoensis, 2352 nodosus, 2353 Richardsonii, 2356, 2370 illinoensis, 2371 praelongus, 2373 gramineus × illinoensis, 2377, 2379 illinoensis, 2381, 2387 praelongus, 2388, 2396 illinoensis.

Metcalf & Sperry. 1603 perfoliatus v. bupleuroides, 1621 amplifolius, 1622, 1630 nodosus, 1631 crispus, 1634, 1639 amplifolius, 1684 gramineus × perfoliatus v. bupleuroides, 1690 illinoensis.

Michel. 1356 perfoliatus v. bupleuroides, 1993 amplifolius.

Millman. 2976 gramineus.

Millspaugh, C. F. 457 nodosus.

Moffatt, W. S. 294 amplifolius.

Moldenke, H. N. 752 illinoensis, 4207 gramineus v. maximus, 4208, 9396 nodosus, 9397 perfoliatus v. bupleuroides.

Moore, A. H. 89 natans, 945 crispus, 2488 amplifolius, 5022 gramineus, 5036 amplifolius.

Moore, E. 1488 natans.

Moore, G. 81 amplifolius.

Moore & Steyermark. 3667 illinoensis.

Morris, E. L. A41 natans, 1343 perhaps gramineus × nodosus (possibly illinoensis × nodosus).

Mosier, C. A. 352 illinoensis.

Moyle, J. B. 61a Richardsonii, 894 alpinus v. tenuifolius, 2052 illinoensis, 2261 amplifolius.

Muenscher, W. C. 2739 crispus, 7632 natans, 7633, 7634, 7635 amplifolius, 7640 gramineus approaching v. myriophyllus, 7642 gramineus, 7643, 7644 natans, 7647 praelongus, 7653, 7654, 7655 Richardsonii, 7657a, 7658 alpinus v. tenuifolius, 10202 natans, 10204 Richardsonii, 10207 gramineus, 10208 gramineus × illinoensis, 10209, 10210, 10211 gramineus, 10212 gramineus × illinoensis, 10216 gramineus, 10218 Richardsonii, 17098 illinoensis, 17104, 17106 gramineus, 17121 Richardsonii, 17545 illinoensis, 17550 gramineus, 17556 praelongus, 17671 natans, 17676 praelongus, 17678 Richardsonii.

Muenscher & Bechtel. 433 nodosus, 434 gramineus, 459 Richardsonii.

Muenscher & Burkholder. 16401 illinoensis, 16846 crispus, 16885 Richardsonii.

Muenscher & Clausen. 3751, 3752 nodosus, 3756 illinoensis, 3757, 3758, 3759 perfoliatus v. bupleuroides, 3770 gramineus v. maximus, 3772 gramineus (perhaps v. myriophyllus), 3773 gramineus approaching v. myriophyllus, 3775 gramineus v., 3784 perhaps amplifolius × Richardsonii, 4161, 4164 amplifolius, 4167 perfoliatus v. bupleuroides, 4190 gramineus, 4205 praelongus, 4209 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii, 4210 perfoliatus v. bupleuroides, 4232, 4233, 4235, 4238 illinoensis.

Muenscher & Curtis. 4827, 4828 nodosus, 4841 gramineus v. maximus, 5423 amplifolius, 5425, 5427 illinoensis, 5430, 5433, 5436 perfoliatus v. bupleuroides, 5466 praelongus, 4835 illinoensis, 4837 amplifolius, 4839, 4843, 4844 illinoensis, 4876 gramineus approaching v. myriophyllus, 4877, 4880 gramineus, 4900 praelongus, 4918 perhaps gramineus × perfoliatus v. bupleuroides.

Muenscher & Lindsey. 2712 alpinus v. tenuifolius, 2715 perhaps gramineus × nodosus, 2716 nodosus, 2719, 2723, 2724 amplifolius, 2725a illinoensis, 2726 perhaps perfoliatus v. bupleuroides × Richardsonii, 2728, 2730, 2732 perfoliatus v. bupleuroides, 2739 crispus, 2769 gramineus v. maximus, 2770

gramineus × perfoliatus v. bupleuroides, 2775 gramineus v. myriophyllus, 2777 gramineus approaching v. maximus, 2780 gramineus approaching v. myriophyllus, 2782 gramineus, 2785 gramineus approaching v. myriophyllus, 2786 gramineus × illinoensis, 2788 natans, 2799 Oakesianus, 2814a praelongus, 2814b perhaps amplifolius × praelongus, 2819, 2820 praelongus, 2830 Richardsonii, 2863 alpinus v. tenuifolius, 2865 gramineus × perfoliatus v. bupleuroides.

Muenscher & Maguire. 713, 715 gramineus v. maximus, 717, 718, 719, 721, 722, 723 amplifolius, 726 alpinus v. tenuifolius, 729 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii), 730, 732 perfoliatus v. bupleuroides, 778 gramineus, 781 gramineus approaching v. maximus, 782 gramineus, 787 gramineus approaching v. maximus, 789, 793 gramineus, 796, 797, 800, 804, 805, 809, 812, 813 natans, 825, 827, 829, 831, 834 praelongus, 857, 858 gramineus, 1582 perhaps gramineus × perfoliatus v. bupleuroides, 1583, 1588, 1591, 1592 nodosus, 1593, 1593a, 1594, 1599, 1600, 1601 amplifolius, 1604b, 1605, 1606 illinoensis, 1607c, 1608, 1609 perfoliatus v. bupleuroides, 1618 crispus, 1676 illinoensis, 1677, 1679 gramineus, 1680 illinoensis, 1683 gramineus, 1684 gramineus × illinoensis, 1686, 1689, 1690 gramineus, 1691 gramineus approaching v. maximus, 1692, 1693 gramineus v. maximus, 1695 gramineus, 1696 gramineus approaching v. maximus, 1699 gramineus, 1700, 1701 illinoensis, 1703, 1705, 1706, 1709, 1710 natans, 1711, 1715, 1716, 1717 Oakesianus, 1747, 1748 praelongus, 1751 illinoensis, 1753, 1754, 1756 praelongus, 1773, 1775, 1776, 1779, 1781, 1782 Richardsonii, 1783 perhaps perfoliatus v. bupleuroides × Richardsonii, 1787 Richardsonii, 1806 illinoensis.

Muenscher, Manning & Maguire. 67, 71 amplifolius, 73, 75 gramineus × illinoensis, 120 gramineus approaching v. maximus, 141 praelongus, 157 perhaps perfoliatus v. bupleuroides × Richardsonii.

Muenscher & Wiegand. 14538 perhaps gramineus × sp.

Munz, P. A. 2785 crispus, 10805 illinoensis.

Murdoch, J. 524 perfoliatus v. bupleuroides, 939 amplifolius, 2062 Oakesianus.

Nash, G. V. 786 crispus, 859, 1750 illinoensis.

Nelson, A. 2276 Richardsonii, 2406 gramineus v., 4145 natans.

Nelson, A. & E. 6061 gramineus v. maximus, 6770 natans (ecological form, perhaps a hybrid), 6771 perhaps gramineus × illinoensis, 6807 Richardsonii.

Nelson, A. & Ruth A. 973 praelongus.

Nelson, E. 87, 3362 Richardsonii, 3386 illinoensis.

Nelson, J. C. 1840 Richardsonii.

Nichols, G. E. 694 perfoliatus v. bupleuroides, 749, 875 natans, 876 gramineus, 1037 gramineus × perfoliatus v. bupleuroides.

Northrop, J. I. 79 natans.

Ogden, E. C. 914, 964 gramineus v. maximus, 1502 crispus, 1620 natans, 1701 perfoliatus v. bupleuroides, 1702 alpinus v. tenuifolius, 1704 amplifolius, 1705 natans, 1716 gramineus, 1717 Richardsonii, 1718 natans, 1725 alpinus v. tenuifolius, 1887 Oakesianus.

Ogden & Babel. 2166 Oakesianus, 2203 gramineus.

Ogden, Babel & Chamberlain. 2242 alpinus v. tenuifolius.

Ogden, Babel & Kozicky. 1880 praelongus.

Ogden & Bolan. 1560, 1562 Oakesianus, 1565 natans, 1568 nodosus, 1569 illinoensis, 1571 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides × Richardsonii), 1578 gramineus × perfoliatus v. bupleuroides, 1580 natans, 1582 Richardsonii, 1583 amplifolius, 1584 nodosus, 1589 Richardsonii, 1589½ illinoensis × nodosus, 1590, 1629, 1630 nodosus, 1631, 1643 Richardsonii, 1644, 1645 gramineus, 1646 natans, 1647 amplifolius, 1676 natans, 1677 gramineus, 1678 Richardsonii, 1680 gramineus, 1681 gramineus × Richardsonii.

Ogden & Hubert. 1537 perfoliatus v. bupleuroides, 1538 crispus.

Ogden & Marston. 432 perfoli-

atus v. bupleuroides, 492 praelongus, 493 perfoliatus v. bupleuroides, 1691 gramineus, 1692, 1693 amplifolius, 1694 gramineus v. maximus, 1698 gramineus.

Ogden, E. C. & Edith B. 1762 gramineus × illinoensis, 1765 gramineus v. myriophyllus, 2008 perfoliatus v. bupleuroides, 2013 gramineus, 2016 amplifolius, 2020 praelongus, 2032 perfoliatus v. bupleuroides.

Ogden, Ogden & Babel. 2271 natans, 2272 amplifolius, 2294 Richardsonii, 2308 gramineus.

Ogden, Ogden & Steinmetz. 1882 praelongus.

Ogden & Palmer. 1505 perfoliatus v. bupleuroides, 1506 natans.

Ogden, Rollins & Wiggins. 1731 Berchtoldi × perfoliatus v. bupleuroides, 1732 perfoliatus v. bupleuroides.

Ogden & Steinmetz. 1542 natans, 1543 gramineus v. maximus, 1544 perfoliatus v. bupleuroides, 1544½ gramineus × perfoliatus v. bupleuroides, 1545 gramineus, 1547 amplifolius, 1548 natans, 1549 gramineus, 1552 gramineus v. maximus, 1556 amplifolius, 1592 praelongus, 1593, 1602, 1603 gramineus v. maximus, 1604 praelongus, 1605 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides × Richardsonii), 1607 perhaps gramineus × nodosus, 1612 gramineus, 1613, 1614 amplifolius, 1615 natans, 1772 Oakesianus, 2189 gramineus v. maximus, 2190 nodosus, 2191 gramineus approaching v. maximus, 2192 perfoliatus v. bupleuroides, 2193 gramineus v. maximus, 2195 gramineus × perfoliatus v. bupleuroides.

Ogden, Steinmetz & Prince. 1596 nodosus, 1597 gramineus v. maximus.

Ogden & Trask. 2073 Oakesianus.

Ogden & Wiggins. 1729 amplifolius.

Ogden & Wright. 2342 gramineus × perfoliatus v. bupleuroides (perhaps alpinus × gramineus), 2343 alpinus v. tenuifolius, 2344 gramineus v. maximus.

Oosting, H. J. 291 gramineus, 302 Richardsonii, 2938, 2945 illinoensis, 2971 Richardsonii, 28100 gramineus, 28164 gramineus × illinoensis, 28166 gramineus.

Ostenfeld, C. H. 553 Richardsonii.

Osterhout, G. E. 2885 alpinus v. tenuifolius.

Otis, I. C. 1565 natans, 1583 Richardsonii, 1584 gramineus, 1678 Richardsonii, 1767 praelongus, 1768, 1769 amplifolius.

Over, W. H. 3366, 3367 Richardsonii, 4008 illinoensis, 4044 gramineus, 13817 alpinus v. tenuifolius approaching v. subellipticus, 13818 Richardsonii, 14459 amplifolius, 14460, 14464 Richardsonii, 14466 gramineus, 15425 amplifolius, 15867 gramineus approaching v. maximus, 17129 gramineus v., 17130, 17131, 17132, 17133, 17134, 17135, 17136, 17137 Richardsonii, 17138 gramineus, 17139 natans, 17140 gramineus, 17141, 17142 amplifolius, 17432 nodosus.

Palmer, E. J. 11952 nodosus, 12217 illinoensis, 12907 perhaps illinoensis × nodosus, 21526 nodosus, 33310 pulcher, 33707, 43586 nodosus.

Palmer, E. L. 36, 37, 38 natans, 50 Richardsonii.

Palmer, L. J. 638 gramineus v. maximus and Richardsonii, 1862 Richardsonii, 1866 gramineus.

Palmer & Steyermark. 41417 pulcher.

Pammel, L. H. 100 natans, 776 illinoensis.

Parish, S. B. 2106, 2128, 3350 nodosus, 3414 natans.

Parish, S. B. & W. F. 1435 natans.

Parlin, J. C. 1073 perfoliatus v. bupleuroides.

Parlin & Fernald. 924 natans.

Payson, E. 174 illinoensis.

Payson, E. B. & Lois B. 2023 Richardsonii, 2024 praelongus, 2251 natans.

Pease, A. S. 1919 alpinus v. subellipticus, 2011 pulcher, 2064 crispus, 2500 gramineus, 2589 gramineus v. maximus, 2907 alpinus v. tenuifolius, 3795 natans, 4699A Oakesianus, 5314A gramineus, 11982 Richardsonii, 12143 perfoliatus v. bupleuroides, 12171 Oakesianus, 13821 gramineus, 13883 amplifolius, 14012 praelongus, 14582 gramineus, 14585 amplifolius, 16591, 16943 perfoliatus v. bupleuroides,

17024 alpinus v. tenuifolius approaching v. subellipticus, 17185 amplifolius, 17270 alpinus v. tenuifolius approaching v. subellipticus, 17983 Richardsonii, 20073 natans, 22752, 22753, 22754 gramineus, 25217 natans, 26709 alpinus v. tenuifolius.

Pease & Bean. 26092 gramineus, 26094 Richardsonii, 26199 amplifolius, 26247 Richardsonii, 26304 gramineus, 26389 Richardsonii.

Pease & Edgerton. 27169 gramineus.

Pease & Fernald. 16958 amplifolius, 17024 alpinus v. tenuifolius approaching v. subellipticus, 17047 natans.

Pease & Hopkins. 22692 perfoliatus v. bupleuroides.

Pease & Ogden. 24828 Richardsonii, 24911 gramineus, 24918 Richardsonii, 24964 illinoensis, 24965 natans, 25013, 25031 Richardsonii, 25032 amplifolius, 25135 Oakesianus, 25167 amplifolius.

Peattie, D. C. 235 Richardsonii, 2305 gramineus v. myriophyllus.

Peck, C. H. 2 perhaps alpinus × nodosus, 3 illinoensis.

Peck, M. E. 6284 Richardsonii, 8514 natans, 9009 Richardsonii, 9026 amplifolius, 9619 Richardsonii.

Peebles, R. H. 14190 nodosus.

Pennell, F. W. 3351 perfoliatus v. bupleuroides, 16220 Richardsonii, 16332 gramineus, 16333 gramineus × illinoensis, 16664 gramineus.

Pepoon, H. S. 156, 159 illinoensis, 899 praelongus.

Perry & Roscoe. 38 Oakesianus.

Phelps, O. P. 1091 nodosus, 1092, 1655 perfoliatus v. bupleuroides, 1665 nodosus.

Pieters, A. J. 3 Richardsonii, 6 gramineus, 7 illinoensis.

Piper, C. V. 757 Richardsonii, 758 natans, 3684 amplifolius, 3761 gramineus × illinoensis, 3765 natans, 4426 alpinus v. tenuifolius, 4430 Richardsonii, 4431 gramineus approaching v. maximus.

Polunin, N. 1976, 1977, 2062 alpinus v. tenuifolius, 2070 perhaps alpinus × gramineus.

Pontious & Bartley. 18 nodosus.

Porsild, A. E. 4295 gramineus approaching v. maximus (perhaps gramineus × sp.), 4296 alpinus v. subellipticus.

Porsild, A. E. & R. T. 114 alpinus v. tenuifolius, 847 Richardsonii, 943, 1102 Richardsonii, 1131 gramineus, 1496 alpinus v. tenuifolius, 1497 gramineus, 2955 praelongus, 3098 alpinus v. tenuifolius and Richardsonii, 3099, 5174 gramineus v. maximus.

Prince & Atwood. 1318 Oakesianus, 1405 perfoliatus v. bupleuroides.

Prince & Hyland. 649 gramineus.

Proulx, T. 58 alpinus v. tenuifolius.

Rand & Robinson. 1013 pulcher

Randolph & Wiegand. 9094 nodosus.

Rapp, F. W. 1977, 1979 praelongus, 1990, 2005, 2008 amplifolius, 2031 natans, 2035 amplifolius, 2221 natans, 2232 amplifolius, 2238, 2251, 2262 natans, 2267, 2273, 2292 amplifolius.

Rau, E. A. 88 perfoliatus v. bupleuroides.

Raup, H. M. 1545 perhaps alpinus v. subellipticus, 1546 gramineus v. maximus, 1547 gramineus × Richardsonii, 1548 gramineus v. maximus, 1551, 1552, 1553, 1554, 1555, 1556, 1557, 1558, 1559, 1560 Richardsonii, 1570, 1571, 1572 praelongus, 6352, 6497-a Richardsonii. 6498-a alpinus v. tenuifolius, 6617 Richardsonii, 6618, 6621, 6622, 6741 alpinus v. tenuifolius, 6742 alpinus v. subellipticus, 6823, 6849, 7002 gramineus.

Raup & Abbe. 4038 gramineus, 4313 natans, 4614 gramineus, 4666 Richardsonii.

Redfield, J. H. 7996 pulcher, 8002 perfoliatus v. bupleuroides, 8014 alpinus v. subellipticus, 15341 perfoliatus v. bupleuroides.

Reed, E. L. 3168 nodosus.

Reverchon, J. 1640 illinoensis, 2502 pulcher.

Ricard & Boivin. 342 nodosus.

Ricker, P. L. 600 natans.

Rider, Sadie L. 349 Richardsonii.

Ridgway, R. 3318 nodosus.

Ridgway & Eaton. 3425 nodosus.

Riehl, N. 128 pulcher.

Robinson, B. L. 494 natans.

Robinson & Maxon. 114 natans.

Robinson & Schrenk. 207 perfoliatus v. bupleuroides, 231 poly-

gonifolius, 232 gramineus approaching v. maximus.

Robinson & Webb. 1087 perfoliatus v. bupleuroides (perhaps a hybrid).

Rolland-Germain. 6231 gramineus, 6233, 6235 gramineus v. maximus, 6280 amplifolius, 8696 perfoliatus v. bupleuroides, 8697, 13044 amplifolius, 16055 Richardsonii, 16058 alpinus v. tenuifolius, 16061 natans, 19251 gramineus approaching v. maximus, 19269 nodosus, 43354, 43356 Richardsonii, 43357 perfoliatus v. bupleuroides, 43358 perhaps alpinus × perfoliatus v. bupleuroides, 43359 nodosus, 43360 perhaps gramineus × perfoliatus v. bupleuroides, 43361 gramineus × perfoliatus v. bupleuroides, 43363 natans, 43367, 43368, 43376 gramineus × perfoliatus v. bupleuroides, 43377 perhaps gramineus × perfoliatus v. bupleuroides, 43378 gramineus × perfoliatus v. bupleuroides, 43379, 43380, 43381 perhaps gramineus × perfoliatus v. bupleuroides, 43382 gramineus × perfoliatus v. bupleuroides, 43481 Richardsonii.

Rollins, R. C. 2319 alpinus v. tenuifolius.

Rollins & Chambers. 2590 natans.

Rose & Painter. 8205 nodosus.

Rosendahl, C. O. 790 natans.

Rosendahl & Butters. 4638 gramineus v. maximus.

Rosenvinge, L. K. 2990 gramineus.

Rossbach, G. B. 51 gramineus v., 55 natans, 59 alpinus v. subellipticus, 60 natans, 61, 62, 63 amplifolius, 70, 71, 72 gramineus, 73 gramineus v. maximus, 74 perfoliatus v. bupleuroides, 75 gramineus, 76, 77, 78 perfoliatus v. bupleuroides, 82 praelongus.

Rossbach, G. B. & R. P. 16 alpinus v. tenuifolius, 17 gramineus, 20 gramineus v. maximus.

Rothrock, J. T. 67 Richardsonii.

Rouleau, E. 304 nodosus, 1185 perfoliatus v. bupleuroides.

Roush, Eva M. F. 812 natans.

Rousseau, J. 20444, 20445 gramineus × perfoliatus v. bupleuroides, 20448 amplifolius, 25814 Oakesianus, 25817, 30003 natans, 30004 praelongus, 31207, 32297 gramineus, 32332 alpinus v. tenuifolius, 32393 perhaps gramineus × perfoliatus v. bupleuroides, 35293 Oakesianus, 35812 perfoliatus v. bupleuroides.

Rugel, F. 613 illinoensis.

Rust, H. J. 384 alpinus v. subellipticus, 385 natans.

Ruth, A. 49, 56, 141, 772 nodosus.

Rydberg, P. A. 1421 nodosus, 1440 illinoensis, 1652 natans, 1792 Richardsonii, 1846 nodosus.

Rydberg & Bessey. 3724, 3725 alpinus v. tenuifolius.

Rydberg & Carlton. 7522 Richardsonii.

St. Cyr, D. N. 2973 gramineus, 2994 amplifolius, 3030 nodosus, 3050 Richardsonii.

St. John, H. 1121, 1122 polygonifolius, 1124 perfoliatus v. bupleuroides, 1372 natans, 1373 Oakesianus, 1756 alpinus v. subellipticus, 1758 gramineus approaching v. maximus, 2540, 2542 perfoliatus v. bupleuroides, 11919 gramineus v. myriophyllus, 90081 natans, 90083, 90084 alpinus v. tenuifoliius, 90085 alpinus v. subellipticus, 90086 gramineus, 90087 perfoliatus.

St. John, English, Moore & Palmer. 9740 natans.

St. John & Nichols. 2104 alpinus v. tenuifolius, 2105 perfoliatus v. bupleuroides, 2106 natans, 2107 praelongus, 2108 amplifolius, 2109 gramineus v. maximus.

Sandberg, J. H. 33 amplifolius, 225 Richardsonii, 498 gramineus, 636 Richardsonii, 656, 658 amplifolius, 801 Richardsonii, 4927 praelongus.

Sandberg & Leiberg. 524 gramineus v. maximus.

Sandberg, MacDougal & Heller. 697, 939 natans, 955 gramineus, 956 Richardsonii, 1026 gramineus.

Sanford, S. N. F. 1225, 10192 perfoliatus v. bupleuroides.

Sargent, H. E. 29 perfoliatus v. bupleuroides, 31 gramineus × perfoliatus v. bupleuroides, 33 perfoliatus v. bupleuroides.

Schulz, Ellen D. 797 illinoensis.

Scott, W. 16208 crispus, 16431 nodosus, 16432 amplifolius, 16433, 16434 illinoensis, 16438, 16439 crispus, 16443 gramineus, 16444 gramineus v. maximus, 16446,

16447 gramineus, 16448 illinoenis, 16450 gramineus, 16451 praelongus, 16454, 16455, 16457 Richardsonii.

Scovell, J. T. 26 amplifolius and natans, 27a Richardsonii, 28 amplifolius, 32 nodosus, 37 gramineus × illinoensis, 44 gramineus, 45 praelongus, 53 (this number also a linear-leaved species according to Fernald, Mem. Am. Acad. Arts & Sci. 17: pt. 1: 136), 54 illinoensis, 66 praelongus.

Scovell & Clark. 1057 Richardsonii, 1079 illinoensis, 1221 gramineus, 1223 amplifolius, 1321 praelongus.

Seargent, M. 100 nodosus.

Seymour, F. C. 249 amplifolius, 267, 1027 perfoliatus v. bupleuroides, 1487, 1567, 1568 Oakesianus, 1570 perfoliatus v. bupleuroides, 3868 praelongus, 4151 pulcher, 4941 gramineus approaching v. myriophyllus.

Sharp, W. M. 3 Richardsonii, 11 illinoensis, 73, 100 natans, 101 praelongus.

Sharp & Underwood. 33521 nodosus.

Sharples, S. P. 303 nodosus.

Shaw, C. H. 771 Richardsonii, 1200 natans and gramineus.

Shear, C. L. 3745 nodosus, 3804 praelongus, 4524 alpinus v. tenuifolius.

Shear & Bessey. 5328 alpinus v. tenuifolius, 5333 gramineus × Richardsonii.

Shreve, F. 1597, 1622 pulcher.

Shull, G. H. 15 crispus, 39, 95 nodosus, 96 perfoliatus v. bupleuroides, 97 amplifolius, 198 nodosus, 316 perfoliatus v. bupleuroides, 413 amplifolius, 421 nodosus, 431, 456 perfoliatus v. bupleuroides, 465 crispus, 469 perfoliatus v. bupleuroides, 471 illinoensis × nodosus, 473 amplifolius, 474 nodosus.

Shunk & Manning. 70 Richardsonii, 80 praelongus, 83 natans, 220 Richardsonii, 225 natans, 229 praelongus, 236 Richardsonii, 237 illinoensis, 298 gramineus, 307 illinoensis, 328 gramineus, 337 natans, 368 praelongus, 398 Richardsonii, 410 praelongus, 492 Richardsonii, 495 illinoensis, 505 praelongus, 511 Richardsonii, 553 amplifolius, 560 Richardsonii.

Simpson, J. H. 386 illinoensis.

Small, J. K. 7241, 8170 illinoensis.

Small & Carter. 1007, 1118 illinoensis.

Small, J. K. & G. K. 4143, 4437, 4486 illinoensis.

Smiley, F. J. 330 natans, 749 nodosus.

Smith, E. F. 57 praelongus.

Smith, L. B. 632 natans.

Smith & Pound. 228 natans.

Sones, G. D. 307 nodosus.

Sperry, C. C. 509 pulcher.

Sperry & Martin. 671 Richardsonii, 696 praelongus, 718 Richardsonii, 719 gramineus, 731, 735 illinoensis.

Spreadborough, W. 16429 alpinus v. tenuifolius, 20750 gramineus, 62662, 62663 Richardsonii.

Standley, P. C. 7557 gramineus v., 9780 nodosus, 16855, 17398 alpinus v. tenuifolius, 18500 natans, 18528 amplifolius, 40488 illinoensis, 40649 gramineus.

Standley & Killip. 7648 amplifolius, 7649 nodosus.

Stecker, A. 332 alpinus v. tenuifolius.

Steenis, J. H. 4741 alpinus v. tenuifolius, 4781 Richardsonii.

Steinmetz, F. H. 94 amplifolius, 149 gramineus × sp., 320 gramineus × perfoliatus v. bupleuroides (perhaps alpinus × gramineus), 323 alpinus v. tenuifolius, 351 gramineus, 356 gramineus v. maximus, 357 gramineus × sp., 358 gramineus, 365 gramineus v. maximus, 367 amplifolius, 370 gramineus, 374 perfoliatus v. bupleuroides, 381 gramineus, 385 perfoliatus v. bupleuroides, 404 gramineus v., 412 amplifolius, 420, 526 perfoliatus v. bupleuroides, 527 perhaps gramineus × nodosus, 617 Berchtoldi × perfoliatus v. bupleuroides, 626 amplifolius, 627 gramineus, 630 natans, 732 gramineus v. maximus, 791 perhaps perfoliatus v. bupleuroides × Richardsonii, 830 natans, 950 amplifolius, 957 nodosus, 1127 Oakesianus.

Steinmetz & Babel. 888 gramineus × perfoliatus v. bupleuroides, 889 perfoliatus v. bupleuroides, 905 nodosus.

Steinmetz & Marston. 539 Berchtoldi × perfoliatus v. bupleuroides.

Steinmetz & Ogden. 98 amplifolius.
Steinmetz & Quimby. 581 gramineus, 582 praelongus.
Steinmetz & Swanson. 30 natans, 31 nodosus, 55 gramineus.
Stevens, G. W. 1364 amplifolius and nodosus.
Steyermark, J. A. 1003 natans, 4227 crispus, 4327 pulcher, 4473 natans, 4609 illinoensis, 4639, 4688, 4728 amplifolius, 5410 nodosus (perhaps illinoensis × nodosus), 5411, 9233 nodosus, 11323, 11939 illinoensis, 11946 amplifolius, 12031, 12428 illinoensis, 13782, 13869 amplifolius, 13910, 13938, 14226 illinoensis, 14245 pulcher, 14257, 14259 nodosus, 14285 illinoensis, 14487, 14624, 15560 amplifolius, 16313 crispus, 21087, 21138, 21145 illinoensis, 21208 amplifolius, 21235 illinoensis, 21269 amplifolius, 22031 nodosus, 22773, 22840, 22873, 23321, 23365 amplifolius, 23494, 23543, 23546 amplifolius, 24650 nodosus, 25008 amplifolius, 25009 illinoensis, 25102, 25103 nodosus, 25104, 25142 illinoensis, 25249, 25250, 25317 nodosus, 25365 illinoensis, 25367 nodosus, 25370 illinoensis, 25425 nodosus, 25533 amplifolius, 25534, 25603, 25876, 27148, 27635, 27657, 27901 nodosus, 27967, 28004, 28005 illinoensis, 28009a nodosus, 28026, 28034a, 28044 illinoensis, 28071 amplifolius, 28080 illinoensis.
Street & Williams. 2689 nodosus.
Suksdorf, W. N. 728 nodosus, 2172 alpinus v. tenuifolius.
Svenson, H. K. 156 pulcher, 7216 nodosus, 9108, 9427, 10150 pulcher.
Svenson & Fassett. 932 perfoliatus v. bupleuroides, 933 perfoliatus, 934 nodosus, 3025 gramineus × perfoliatus v. bupleuroides, 3028 alpinus v. subellipticus, 3030 gramineus × perfoliatus v. bupleuroides, 3031 3040 perfoliatus v. bupleuroides, 3045 Richardsonii, 3046 gramineus.
Svenson & Smith. 822 perfoliatus v. bupleuroides.
Tanner, V. M. 5786 praelongus × Richardsonii.
Taylor, W. P. 78 gramineus × illinoensis.
Taylor, Hosie, Fitzpatrick, Losee & Leslie. 280 amplifolius, 291 gramineus, 293 Richardsonii, 294 alpinus v. subellipticus, 295, 296 natans, 297 Oakesianus, 299 gramineus, 300 Richardsonii, 303 gramineus, 304 gramineus × Richardsonii (probably backcrossed with gramineus), 305 gramineus.
Tharp, B. C. 2181 illinoensis.
Thomas, C. C. 1494 perhaps gramineus × nodosus, 1499 gramineus, 3466 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides × Richardsonii).
Thompson, H. D. 8 Richardsonii.
Thompson, J. W. 7589 gramineus, 7594 Richardsonii, 8620 amplifolius, 9422½ natans, 11768 gramineus v. maximus, 14046g ramineus.
Thomson, R. 2 praelongus, 5 Richardsonii, 7 natans, 16 gramineus, 53 illinoensis, 69 gramineus, 73b gramineus × illinoensis, 142 Richardsonii, 145 illinoensis, 153 gramineus, 222 Richardsonii, 232 natans, 253 gramineus, 299 Richardsonii, 361, 365 gramineus, 369 Richardsonii, 382 natans.
Thurber, G. 48 illinoensis.
Tidestrom, I. 517, 1861 illinoensis, 7171 nodosus, 7175 perfoliatus v. bupleuroides, 7183, 7637, 7741, 10655 nodosus.
Tolstead, W. L. 428 natans, 429 Richardsonii, 430 praelongus, 473 Richardsonii, 614 illinoensis, 615 gramineus, 616 gramineus × illinoensis, 637 nodosus, 638 natans, 41500 nodosus.
Topping, D. L. 203 amplifolius.
Toumey, J. W. 496 nodosus.
Tracy, J. P. 4406 natans.
Trelease, W. 2865, 2867 gramineus, 2870, 2871 alpinus v. tenuifolius.
Tweedy, F. 45 illinoensis, 411 gramineus, 413 Richardsonii, 4978 gramineus.
Uhler & McLaughlin. 362, 373 Richardsonii, 375, 1091 gramineus × illinoensis.
Uhler & Martin. 1645 Richardsonii, 1656 gramineus, 1659 Richardsonii, 1660 natans, 1662 illinoensis, 1666 gramineus (perhaps gramineus × illinoensis).
Uhler & Warren. 793 natans, 797½ praelongus, 858 illinoensis, 1079 praelongus.

Umbach, L. M. 31 gramineus, 433 Richardsonii, 457 gramineus v. maximus.
Van Dyke, E. C. 202 alpinus v. tenuifolius.
VanEseltine & Moseley. 201 crispus, 202 nodosus.
Victorin, Marie- 526 gramineus, 565 perfoliatus v. bupleuroides, 1124 gramineus, 1152, 1505 alpinus v. tenuifolius, 1537 natans, 1539 gramineus, 3177 perfoliatus v. bupleuroides, 3231 Richardsonii, 4195, 7330 gramineus, 8176 gramineus × perfoliatus v. bupleuroides, 8177, 8178 perfoliatus v. bupleuroides, 8179 Richardsonii, 8187, 8192, 8193 gramineus, 8194, 8195 gramineus v. maximus, 9924, 10104 perfoliatus v. bupleuroides, 11160 natans, 11162 alpinus v. tenuifolius, 11165 perfoliatus v. bupleuroides approaching v. typicus, 11166 perhaps alpinus × perfoliatus v. bupleuroides, 11169 perhaps gramineus × perfoliatus v. bupleuroides, 11170 perfoliatus v. bupleuroides, 16052 natans, 16056 Richardsonii, 16057 gramineus, 16062, 16063 natans, 16064 gramineus v. maximus, 16065 amplifolius, 18460 alpinus v. tenuifolius, 18462 Richardsonii, 20451 gramineus, 20452 gramineus v. maximus, 20454 perfoliatus, 20456 perfoliatus v. bupleuroides, 20457, 21201, 25815 amplifolius, 27897 perfoliatus v. bupleuroides, 28603 gramineus, 28604 gramineus × perfoliatus v. bupleuroides, 28605 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii).
Victorin & Rolland. 9922 Oakesianus, 9923 alpinus v. subellipticus, 9924 perfoliatus v. bupleuroides, 18575 alpinus v. subellipticus, 18576 gramineus, 20462, 20468 alpinus v. subellipticus, 25609, 25810 gramineus, 25938 alpinus v. subellipticus, 25939, 27094, 27095 gramineus v. maximus, 27630 alpinus v. tenuifolius, 29088 perfoliatus v. bupleuroides, 33178 Richardsonii (perhaps perfoliatus v. bupleuroides × Richardsonii), 33180 gramineus v. maximus, 33879 perfoliatus v. bupleuroides, 43565 nodosus, 43576, 43796 perfoliatus v. bupleuroides, 44070 natans, 44738 gramineus × perfoliatus v. bupleuroides, 45184 Richardsonii, 45189 crispus, 46699 nodosus, 49141 crispus, 49148 Richardsonii, 49304 nodosus, 49366 amplifolius.
Victorin, Rolland, Brunel & Rousseau. 17278 perfoliatus v. bupleuroides, 17285 gramineus approaching v. maximus, 17286 perfoliatus v. bupleuroides.
Victorin, Rolland & Jacques. 33315 alpinus v. subellipticus, 33316 natans, 33393 perfoliatus approaching v. bupleuroides, 33477 gramineus, 33517 amplifolius, 33518 praelongus, 33609 Richardsonii, 33639 Oakesianus, 33838 praelongus, 33854, 33856 natans, 33858 amplifolius, 33879 perfoliatus v. bupleuroides, 33714, 33855 gramineus, 44182 praelongus, 44451 alpinus v. subellipticus, 44452 gramineus, 44453 gramineus × perfoliatus v. bupleuroides (probably backcrossed with gramineus), 44454, 44458 gramineus, 44459 gramineus × perfoliatus v. bupleuroides, 44460 natans, 44463 gramineus v., 44465 gramineus, 44467 perfoliatus v. bupleuroides, 44468 alpinus v. subellipticus, 44749 Oakesianus.
Victorin, Rolland & Louis-Marie. 20467 alpinus v. subellipticus.
Victorin, Rolland & Meilleur. 43730 alpinus v. tenuifolius, 43858 nodosus, 44382 gramineus v. or gramineus × sp., 44728 natans, 45446 Richardsonii.
Victorin, Rolland, Michel & Meilleur. 43633 Oakesianus.
Waghorne, A. C. 6 alpinus v. tenuifolius, 40 perfoliatus v. bupleuroides.
Wahl, H. A. 174 amplifolius, 204 perfoliatus, v. bupleuroides, 240 perfoliatus v. bupleuroides (perhaps perfoliatus v. bupleuroides × sp.).
Walker, Mr. & Mrs. E. P. 994 natans.
Ware, R. A. 2446 perfoliatus v. bupleuroides, 3324 natans, 3326 amplifolius.
Warnock, B. H. T557 nodosus.
Watson, S. 396 perhaps alpinus × gramineus, 397 Richardsonii, 398 nodosus, 1131 natans, 1132 alpinus v. tenuifolius, 1133 nodosus (perhaps illinoensis × nodosus), 1134 gramineus, 1135 Richardsonii.
Watson, W. R. 969 gramineus, 973

gramineus approaching v. maximus, 979 natans, 1006 amplifolius, 1023 Richardsonii, 1178 amplifolius, 1253, 1418 gramineus, 3142 natans, 3144, 3145 alpinus v. subellipticus, 3158 gramineus, 3651 Richardsonii.

Weatherby, C. A. D2409 amplifolius, 3389 gramineus, 4364 natans.

Weatherby & Anderson. 5901 amplifolius, 5904 natans.

Weatherby, C. A. & Una F. 5625 gramineus approaching v. maximus, 6624 gramineus.

Webb, R. J. 452, 546 amplifolius.

Webber, H. J. 4 amplifolius, 5, 6 nodosus.

Welch, Winona H. 2106 nodosus.

Werner, W. C. 954 illinoensis.

Wetmore, A. 395 nodosus, 541 natans, 549 gramineus v. maximus, 550 gramineus.

Wetmore, R. H. 103096 gramineus v. maximus.

Wetmore. 2988 gramineus.

Wheeler, C. F. 7 natans, 10 praelongus, 11, 12 illinoensis, 13 amplifolius, 16 illinoensis, 19 Richardsonii, 21, 24 illinoensis, 26 alpinus v. tenuifolius, 27 gramineus, 89 Richardsonii, 90 alpinus v. tenuifolius, 231 illinoensis, 273 praelongus.

Wheeler, L. C. 1974 nodosus, 3973 natans.

Whited, K. 3141 Richardsonii.

Whitford, H. N. 251 gramineus, 254 natans, 258 alpinus v. tenuifolius.

Whitney, Elsie G. 4673a amplifolius.

Wiegand, K. M. 11178 illinoensis, 11182 crispus.

Wiegand, Gilbert & Hotchkiss. 27339 Oakesianus.

Wiegand & Hotchkiss. 27337 alpinus v. tenuifolius, 27343 gramineus × perfoliatus v. bupleuroides (probably backcrossed with gramineus).

Wiegand & Pease. 27340 gramineus.

Wight, W. F. 1 praelongus, 8 illinoensis, 9 natans, 59 illinoensis, 61 gramineus, 76 illinoensis, 86, 87a, 87b, 87c, 88 nodosus, 97 amplifolius, 98 nodosus, 109 amplifolius, 123 nodosus, 152 natans.

Wiggins, I. L. 6757 natans, 6775 gramineus v. maximus, 6777 natans, 6796 gramineus, 6797 natans.

Williams, R. S. 285 nodosus, 804 Richardsonii, 900 gramineus.

Williams, T. A. 1 nodosus, 344 amplifolius.

Williamson, C. S. 418 Oakesianus, 455 polygonifolius, 472, 1026 perfoliatus v. bupleuroides.

Williamson, Mrs. W. T. 309 nodosus.

Wilson, P. 189 amplifolius.

Wolf, J. 760 alpinus v. tenuifolius, 961 gramineus.

Wolff, Simon E. 3290 nodosus.

Wood, F. F. 4 Richardsonii.

Wright, C. 675 nodosus, 676 illinoensis, 1893 nodosus.

Young, J. P. 542 illinoensis.

Yuncker, T. G. 361 amplifolius, 713 praelongus.

Yuncker, T. G. & E. C. 7011 Richardsonii.

Zeller, S. M. & E. B. 1237 gramineus, 1238 amplifolius.

CALTHA NATANS IN CANADA.—Lakela's[1] interesting account of the rediscovery of *Caltha natans* Pall. in Minnesota in 1942, recalls the collection of this species by W. N. Denike at Ingolf, Ontario, in July, 1940. I recorded this collection, which was the first Ontario record, in the Canadian Field-Naturalist, **55:** 18 (1941) and at the same time presented an account of the known distribution in Canada and the United States. It should be

[1] Lakela, O., RHODORA, **45**: 53–55 (1943).

noted that one Manitoba record exists, namely a collection by Lowe from a creek between High Lake and Falcon Bay, August, 1920.—Harold A. Senn, Division of Botany, Department of Agriculture, Ottawa, Canada.

Polygonum puritanorum in Maine.—On the wet sandy beach of Keoka Lake, at Waterford, Oxford County, Maine, on 8 July, 1941, I collected a small *Polygonum*, suggesting *P. Persicaria* L., yet different enough in aspect from that species to make me hesitate in determining its exact status. Professor Fernald has kindly identified it as *P. puritanorum* Fern., a coastal plain species published in Rhodora, xxi. 141 (1919) from Plymouth and Barnstable Counties, Massachusetts, to which Grand Lake, Annapolis Co., Nova Scotia, was later added. The broad strand of Keoka Lake—in 1941 perhaps more extensively uncovered than usual—matches well the habitats in which this plant has previously been collected, and supports as very abundant neighbors such plants as *Gratiola aurea* and *Utricularia cornuta*. This somewhat inland station is not out of keeping with the appearance of certain other coastal plain plants in the region of Ossipee and Madison, New Hampshire, and again emphasizes the need for more detailed study of this part of western Maine and east-central New Hampshire.—Arthur Stanley Pease, Cambridge, Massachusetts.

A Double-flowered Form of Gillenia trifoliata.—During a collecting trip on June 22, 1941, sponsored by the Department of Botany of the University of Pennsylvania to collect material for a new state flora, a multi-petaled form of *Gillenia trifoliata* was found. A single clump was growing on an open, sunny bank bordering a woods, 1½ miles southeast of Wells Tannery, Fulton County, Pennsylvania. In each flower most of the stamens were replaced by petals so that at a short distance it resembled a miniature double-flowered chrysanthemum, often seen at flower shows. Each flower was decidedly pinkish in color, but in all other respects the plant was like the normal species.

Similar doubling occurs frequently in nature and in plants under cultivation. Hoping to introduce this form into the gardens, a small portion of the root was carefully removed, but the attempt at propagation was unsuccessful. It is hoped that this beautiful plant will remain in existence until such time as the world will be more interested in perpetuating rather than destroying natural beauty so that a second attempt can be made.

Careful checking by Dr. L. H. Bailey of the Bailey Hortorium and Dr. Lyman B. Smith of the Gray Herbarium indicates that this form is as yet undescribed. The name now proposed is

GILLENIA TRIFOLIATA (L.) Moench, forma **multipetala,** f. nov., floribus plenis; staminibus petalis permutatis; inflorescentia globosa supra complanata.

Flowers double by conversion of most stamens to petals; head globose, flattened on top. *J. W. Adams* 5054 (single specimen collected and deposited as the TYPE in the University of Pennsylvania Herbarium).—J. W. ADAMS, The Morris Arboretum of the University of Pennsylvania.

Volume 45, no. 532, including pages 113–168, was issued 10 April, 1943.

JUN 1 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. June, 1943. No. 534.

CONTENTS:

Arthur Herbert Norton. *Ralph C. Bean.* 217

Scabiosa Columbaria in Central New York. *R. T. Clausen.* 220

Contributions from the Gray Herbarium of Harvard University—No. CXLVIII. *M. L. Fernald.*

I. Five common Rhizomatous Species of Muhlenbergia. 221

II. Notes on Danthonia. 239

III. Erianthus brevibarbis and other Species. 246

IV. Why not Andropogon Gerardi? 255

New Streptanthus from the Big Bend of Texas. *V. L. Cory.* ... 258

Varieties of Brachyelytrum erectum. *William K. Babel.* 260

Identity of Aster salsuginosus Richardson. *Arthur Cronquist.* .. 262

The New England Botanical Club, Inc.

8 and 10 West King St., Lancaster, Pa.

Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

Photo. B. G. Schubert

MUHLENBERGIA FRONDOSA (M. FOLIOSA): FIGS. 1–3, fragments of type of AGROSTIS FOLIOSA, × 5; FIG. 4, spikelets, × 4; FIG. 5, floret, × 10; FIG. 6, grain, × 10.

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. June, 1943. No. 534.

ARTHUR HERBERT NORTON

Ralph C. Bean

On January 5, 1943, Arthur Herbert Norton died at his home in Portland, Maine. He had been in failing health since May of the previous year when a critical surgical operation served only to prolong his life for a few months but could not restore him to normal health. He was born on April 19, 1870, on White Head Island in the town of St. George, Maine, the son of Capt. Horace F. Norton, first captain of the Life Saving Station there, and Cynthia Elwell Norton. He attended the St. George schools but received a far broader education on the shores of his native town. Here were unlimited opportunities for study and research on the life of the sea shore, especially of the sea birds. Here he began his observations on birds and their migrations and also began to make collections. In his diary he says: "I wore the covers off a copy of Rev. J. G. Woods' 'Juvenile Natural History'." His father had many good books and read to the children in the evenings, and very often this reading was about Natural History.

In 1885 the family moved to Westbrook, Maine, where Mr. Norton soon found employment in the Haskell silk mill. Here together with his brother he acquired a boat which was kept at the mouth of the Presumpscot River in Falmouth. In his free time he explored Casco Bay and its islands. The observations and studies of these early years laid the foundation for his life work. At this time he decided that he would study Natural History in earnest.

One of his first articles to appear in print was "Nesting of

Contopus borealis at Westbrook, Maine", which appeared in the Oologist in 1890. Through a correspondent he was induced to become an associate of the American Ornithologists' Union. At its meetings he met men who were leaders in the field of bird study. Some of them were particularly interested in his work on the sea birds. As a result of this contact he made an intensive study of the gull colonies of the Maine islands.

In 1898 Mr. Norton decided to give his whole time to his Natural History studies and went to South Carolina equipped to study and photograph birds. He was fairly successful in finding the birds he wished but it was the time of the Spanish American War and his plates were confiscated by the government and his equipment and camera were open to suspicion.

In 1905 Mr. Norton replaced Mr. Charles B. Fuller as Cabinet Keeper of the Natural History Museum at 22 Elm Street, Portland, Maine. Soon after this he moved to Portland where he made his home for the rest of his life. From this time he was identified with the Portland Society of Natural History. He was Curator of the Museum for thirty-seven years.

During his active life he contributed over three hundred articles on various phases of Natural History to scientific publications and for five years he served as editor of the Maine Naturalist. Many of his articles, especially in his earlier years, were written about birds. Such were "Birds of the Bowdoin College Expedition to Labrador" in 1901 and "The Sharptailed Sparrows of Maine" in 1897, published in the Proceedings of the Portland Society of Natural History, and "Birds new or rare in the Fauna of Maine," published in Auk in 1913. In addition there were articles dealing with other animal groups as "The mammals of Portland, Maine, and Vicinity" published in 1930 in the Proceedings of the Portland Society.

Mr. Norton had been working for many years on a "Catalogue of the Birds of Maine". Extensive manuscripts and card files on this project had been accumulated, and this material as well as his extensive library has been presented to the University of Maine. Shortly before his death arrangements had been made with members of the University Faculty to complete this Catalogue.

Mr. Norton's interest in these groups did not diminish as he

grew older but his interest and knowledge of the Flora of Maine increased with the years as his short notes and articles in RHODORA testify. Some of his papers appeared in the Maine Naturalist which was first published in 1920 and of which he became editor in 1926. He contributed much material to the infrequent Bulletins of the Josselyn Botanical Society of Maine. He was president of this organization for the year 1914 and a few years later he was again elected president, an office he held until 1935.

He also served as president of the Cumberland County Audubon Society, and the Maine Audubon Society. He was a charter member of the American Society of Mammalogists and of the Maine Mineralogical and Geological Society. He was also a member of the Portland Society of Natural History, of the Stanton Bird Club of Lewiston and Auburn, Maine, of the American Ornithological Union and of the New England Botanical Club. He was a corresponding member of the Philadelphia Academy of Natural Sciences and of the Cooper Ornithological Club.

Mr. Norton possessed a deep interest in botanical study. His sustained interest in the botany of Maine can be judged by a survey of his notes in RHODORA which began in Volume 4 in 1902 while the last appeared in 1939. Some typical articles are "Plants apparently new to the Maine Catalogue" in 1912, "Some Noteworthy Plants from the Islands and Coast of Maine" in 1913 and "Plants apparently new to Mt. Katahdin" in 1935. While he made trips for observation and collecting to states farther south, his particular field was Maine and there was hardly a section of the State that he had not visited and tramped over. His attendance at the Field Meetings of the Josselyn Botanical Society could always be depended upon. To these meetings he brought his broad background and understanding of the local flora as well as a knowledge of the contributions of others to the flora of that particular region.

My acquaintance with Mr. Norton dates from the Meeting of the Josselyn Botanical Society at Oxford in 1907. There his genuine interest and unselfish helpfulness made the meeting outstanding for the younger members. During the week following the meeting I had the opportunity of being with him in the field

for two memorable days, one along the Presumpscot River near Portland and another in Brunswick where Mr. Norton, Mr. E. B. Chamberlain and myself were the guests of Prof. L. A. Lee of Bowdoin College. The same interest and enthusiasm characterized him in the subsequent meetings that marked him then. The last meeting at which I was with him in the field was the meeting of the Josselyn Botanical Society at Newport in 1941 where he seemed as tireless and eager as in the earlier years.

The lack of extended formal education did not constitute a great handicap to Mr. Norton's chosen career. A recognition of the value of his scientific studies was given him in 1940 when the University of Maine awarded him the degree of Master of Science.

Mr. Norton was modest and retiring by nature and did not like to appear as possessing superior knowledge, but those who came to know him realized that he could answer their questions with authority and accuracy. A marked characteristic was his kindness and patience with amateurs and with anyone who approached him. As a result he was known throughout the State and had an extensive correspondence with men and women in all walks of life. Because of this wide acquaintance many items of scientific interest came to him as well as many specimens for the Portland Society of Natural History. All through the State there are many who feel his passing as a personal loss. Those of us who knew him best realize that the State has lost an excellent botanist and that we have lost a friend whose place cannot be filled.

WAKEFIELD, MASSACHUSETTS

SCABIOSA COLUMBARIA IN CENTRAL NEW YORK.—Several years ago, Dr. Anne E. Perkins collected *Scabiosa Columbaria* L. in an unmown field along the road between Gowanda and Salamanca in Cattaraugus County, New York. She reported about 150 plants in the field. In the late summer of 1942, Dr. Mildred E. Faust and Miss Nettie M. Sadler found this same species established on the top of the hill just southwest of the falls at Delphi, in Oneida County. They have deposited two collections from this locality in the Cornell University Herbarium, one obtained on September 1 and the other on October 8.

S. Columbaria is native in the Old World. Since it is sometimes cultivated in this country, the occurrences mentioned above may have originated from garden sources. No other North American collections are available in the Cornell University Herbarium, suggesting that this perennial is a very recent addition to our introduced flora.—R. T. Clausen, Department of Botany, Cornell University.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—No. CXLVIII

M. L. Fernald

(Plates 749–769)[1]

During the studies necessary in a thorough revision of the flora of northeastern America and, especially, a checking with photographs of the types of Linnaeus, Michaux and other authors of American species much new matter has accumulated. Some of the studies, with photographs by Dr. Bernice G. Schubert, are here presented.

I. FIVE COMMON RHIZOMATOUS SPECIES OF MUHLENBERGIA

(Plates 749–757)

In eastern North America five species of *Muhlenbergia* stand out as the most common representatives of the rhizomatous members of the genus, the plants passing, mostly erroneously, as *M. mexicana* (L.) Trin., *M. sylvatica* Torr., *M. foliosa* (R. & S.) Trin. and the two very distinct species included under *M. racemosa* (Michx.) BSP. These five species have many technical differences (in glumes, lemmas, anthers, grains, internodes, nodes, sheaths, etc.) and habitally they are distinctive. The names currently applied to them, however, need most careful scrutiny for, when the types (all but one in Europe) are studied, it is apparent that those who have easily recognized the species involved have largely guessed at their names and, too often,

[1] The cost of engraver's blocks has been met in part from an appropriation for original research from the Department of Biology, Harvard University.

have not consulted the original descriptions. Sixteen years ago I undertook a clarification of our species, at that time securing from friends in London, Paris and Berlin photographs of many of the types involved; and in 1930, while in Europe, I checked many points not shown in habit-photographs.

As a result of this study it was evident that we must adopt many unfamiliar names or change the significance of those now familiar but, disliking the upheaval necessitated, I have refrained from publication, with the hope that specialists on the *Gramineae* would take the responsibility of correcting the many errors. Having now reached a stage in my work when the facts can no longer be dodged, I am presenting in key-form the diagnostic characters of the five species. This will be followed by consideration of the names now in use and those which, it seems to me, must be taken up. In some instances, however, inability at present to consult many critical specimens abroad may result in slight future changes. In his Manual Hitchcock[1] adopts for

[1] I am credibly informed that Hitchcock strenuously and rightly objected to these absurd names, which were forced into his book through the ruling of his Chief (see Hitchcock, Man. 14), an illustration of the type of intellectual freedom allowed scholarly and original workers in some branches of our "free and democratic" government. In view of the fact that true and heretofore misinterpreted *Muhlenbergia racemosa*, as stated on one of the labels before me, "Grows in the dryest of soil" one wonders how long the inspired name "Marsh Muhly" will be the "standard" name for it. Its originator obviously intended the name for *M. setosa*, a wholly distinct species of bog, swale, peaty meadows and wet shores. Incidentally, the emended name as "Muley" would be wholly inappropriate for either *M. racemosa* or *M. setosa*, species which differ from the others by the very prolonged awns of their glumes; muley, as every farmer-boy knows, implies lack of horns. The prolific inventor of "English" names flatly discriminated against *M. sylvatica*, *M. "foliosa"* and many others, allowing them no "English" names, althogh they are thoroughly distinct and abundant species. This was perhaps fortunate, for the binomials generally applied to them are so liable to upset when studied by scientists. If the time used in inventing "English" names for these plants had gone into study of their proper typification some of the upsets in the following pages might be unnecessary. *"C'est à rire!"*

À propos the reference to dictatorship by some in power over young (sometimes older) scientists, I have recently received copies of correspondence from a botanist formerly in government employ, in which the inventor of "English" names ruled that the young man should not publish a new plant in RHODORA because the type is not in the National Herbarium and because the author had followed the International Rules of Plant Nomenclature, though in this case the dictator was overruled by still higher officials. Probably no more severe blight upon scholarly development of taxonomy under federal dictatorship has existed. The inventor of "English" names himself once made a weak effort in taxonomy. That he did not "arrive" is clear from his greatest monograph, with its delightfully naïve key:

Leaves obovate, etc. . . . . .
Leaves not with all the characters given above, etc.
Leaves not exceeding 2 cm. in length, etc.
. . . . . .
. . . . . .

members of *Muhlenbergia* the stupid "English" name "Muhly" ("Marsh Muhly", "Wire-stem Muhly", etc.). There would be some propriety in dropping the *h* and then applying the word as an adjective to the current nomenclature of the misinterpreted five. In tabulating the characters I am numbering the species, the name in current use being bracketed. Beautifully clear illustrations of four of the plants will be found in Hitchcock's Manual, figs. 768, 770, 774 and 776. I am greatly indebted to Mr. Jason Swallen for an opportunity to study fragments of the types of *Agrostis mexicana* L. and of *A. foliosa* R. & S. Photographs made from them will be found in PLATES 749, FIGS. 1–3 and 751, FIG. 2).

a. Rhizomes and stolons 2–6 mm. thick, with cucullate-arching ovate scales; nodes of culm thick and abruptly enlarged; panicles usually arching, their branches evident; glumes shorter than to about equaling lemma, the longer 2–3.5 mm. long; base of lemma with straight and rather stiff beard; anthers 0.3–0.6 mm. long . . . *b.*

b. Culms loosely ascending to geniculate and rooting at lower nodes, freely branching from basal and middle nodes, the branches soon forking, the plants thus becoming bushy in habit and topheavy, the promptly uncovered internodes lustrous and glabrous; leaf-sheaths loose, laterally compressed, promptly opening to base; terminal panicle exserted, or with included base, at first lax and open, lanceolate to slenderly pyramidal or ellipsoid, later with appressed branches; lateral panicles in axils of many leaves, partly included; many spikelets slender-pedicelled; glumes very unequal, both awned, membranaceous, green or purplish; lemma membranous; grain easily loosened, linear-cylindric, 1.6–2 mm. long . . . . . 1. [*M. mexicana*].

b. Culms erect or ascending, lower nodes not rooting, unbranched or with erect or ascending mostly simple branches from middle nodes, internodes largely covered by sheaths, opaque and puberulent; leaf-sheaths tight, terete, tardily opening to base; panicles all or nearly all terminating culms and erect branches, mostly exserted, linear- to oblong-cylindric; glumes subulate-tipped (if rarely awned, subequal).

Erect, with few simple appressed-ascending branches; leaf-blades ascending or slightly spreading, firm; panicles rather stiff, the subsessile to short-pedicelled spikelets densely imbricated and extending to bases of the glomerulate appressed-ascending branches and branchlets; glumes subequal, firm and herbaceous, usually green or

---

Leaves not with all the characters given above.

Leaves orbicular to oval, etc.

Leaves or other parts not as described above.

and so on, including the informative calls in the key "Leaves not as described". It is no wonder that one who got little deeper than that into an exacting field did not fully understand its importance.

purplish; lemma firm, usually awnless (rarely awned); mature florets persistent; grain slenderly ellipsoid, 1.3–1.6 mm. long, tightly embraced by lemma and palea. 2. [*M. foliosa*].

Ascending to erect, with many ascending simple or forking branches from middle nodes; leaf-blades spreading, rather soft and pliant; panicles slender, loosely flowered, flexuous, the longer branches mostly without crowded basal spikelets, the spikelets often long-pedicelled; glumes very unequal, scarious or hyaline, usually whitish or silvery; lemma scarious, silvery, often long-awned; mature florets promptly dropping; grain linear-cylindric, 1.4–2.1 mm. long, easily removed.....3. [*M. sylvatica*].

a. Rhizomes and stolons slender (2–4 mm. thick), greatly prolonged and forking, with appressed lanceolate to narrowly oblong prolonged scales; nodes of culm gradually enlarged upward; panicles all at tips of culms or branches, stiff, lobulate-spiciform (especially at summit) the stiff branches densely flowered to base; glumes much exceeding lemma, subequal, linear-attenuate and long-awned, 4.5–8 mm. long; lemma slenderly villous at base; anthers 0.5–1.5 mm. long; ripe florets tardily dropping.

Culms mostly branching from middle nodes, the leaves and branches there approximate, the internodes lustrous and glabrous; leaf-sheath acutely keeled, the prolonged ligule 3–5 mm. long; anthers 0.5–0.8 mm. long; grain tightly embraced, linear-cylindric, 1.8–2.2 mm. long; species of dry prairie, rocks and bluffs from Wisconsin to Saskatchewan, and west to Oregon, south to Illinois, Missouri, Kansas and New Mexico; casual along railroads eastward 4. [*M. racemosa*].

Culms simple or with few erect basal branches; the internodes opaque and puberulent; leaf-sheath with rounded midrib, scarcely keeled, the inconspicuous ligule 0.5–1.5 mm. long; anthers 1–1.5 mm. long; grain easily freed, oblong-cylindric, 1.2–1.5 mm. long; species of bogs, wet meadows, wet rocks and shores, from Newfoundland to Alberta, south to North Carolina, Indiana, Wisconsin, Minnesota, Wyoming, Nevada and Oregon.....5. [*M. racemosa*].

True M. mexicana (Plates 751 and 752)

Muhlenbergia mexicana (L.) Trin. Gram. Unifl. 189 (1824) rests upon *Agrostis mexicana* L. Mant. i. 31 (1767). *Agrostis mexicana* was raised by Linnaeus in the garden at Upsala from seeds sent him from Vienna by Jacquin and erroneously thought to have come from tropical America. By most recent authors it is considered to be species no. 1 of the preceding key: "the plants becoming topheavy and bushy", to use Hitchcock's phrase, with abundant decumbent and rooting or ascending often forking lustrous branches; the sheaths compressed and loose, promptly opening to the base; the branches bearing numerous partly included axillary panicles; the terminal panicles relatively

soft and loose upon expanding, many of the spikelets long-pedicelled; the glumes very unequal and both awned; the easily removed grain linear-cylindric, etc. How different was the unusually full description by Linneaus of his *Agrostis mexicana:*

mexicana. 20. AGROSTIS panicula oblonga congesta, calycibus [glumis] corollisque [lemmatibusque] acuminatis subaequalibus muticis. *Habitat in* America *calidiore. D. Jacquin* .♂
Culmi *numerosi, pedales, laeues, erecti.* Ramis *indiuisis.* Folia *laeuiuscula ligula truncata.* Panicula *viridis, oblonga, non patens, sed congesta coaceruatis numerosissimis viridibus floribus.* Flores *scabri.* Calyces *apice subulati, subaequales, parum scabri.* Corollae *longitudine calycis, apice similiter acuminatae, basi pilosae.* Aristae *nullae.* Stigmata *atropurpurea, ramosa.* Stamina *alba. Difficillime hoc Gramen determinatur. Altero anno floret. Facies Cinnae.* H. U.

Passing for the moment the "*panicula oblonga congesta*" or "*congesta coaceruatis*", it should be clear that the "culmi . . . *erecti*" the "Ramis *indiuisis*" and the "Calyces [glumae] *apice subulati, subaequales*" do not belong to species no. 1, which has often decumbent or lopping culms with mostly forking and very abundant basal and median branches, the glumes very unequal and both slenderly awned. The "Aristae *nullae*" could belong to no. 1 or to no. 2. Linnaeus said nothing about the very numerous axillary panicles partly included in the subinflated sheaths of the branches which so generally characterize no. 1. His unusually full description is clearly not a good one for no. 1 and, in view of the almost universal recent error of so identifying it, the original comment of Linnaeus still has force: "*Difficillime hoc Gramen determinatur*". Linnaeus had two sheets of the type material, both clearly marked by him *Agrostis mexicana.* Beautiful photographs of the two sheets, sent to the Gray Herbarium in 1927 by the late Dr. B. Daydon Jackson, are before me. One is of a badly crumpled specimen, the other (our PLATE 751, FIG. 1) better prepared. They both show erect culms, with few simple erect branches, tight sheaths, terminal panicles, no definitely included axillary panicles, subequal awnless glumes (PLATE 751, FIG. 3) and awnless lemmas; and the broken-off culms are 5 dm. (20 inches) high. Linnaeus's "culmi . . . *pedales*" was too conservative. PLATE 752, FIG. 2 is from a portion of the panicle of the type, now preserved at the United States National Herbar-

ium and most generously sent me for study by Mr. Swallen. The type specimens of *Agrostis mexicana* are of species no. 2, the plant passing as *Muhlenbergia foliosa*.

As he stated, Linnaeus received his seed from Jacquin and raised the plant at Upsala. Jacquin's plant at Vienna was clearly described, and illustrated by a life-size colored plate, by the younger Jacquin in his Eclogae Plantarum Rariorum—Gram. Fasc. ter. et quart., 44, t. 30 (1813). Jacquin filius departed little from Linnaeus, his fuller account including "CULMI . . . bipedales, . . . erecti, . . . teretes . . . ; ramis axillaribus, erectis, distichis, adpressis . . . vaginis . . . apertis . . . FLORES in paniculis terminalibus culmi primarii et ramorum, ante et post anthesin coarctatis, . . . ; ramis ramulisque . . . erectis adpressis . . . Calyx . . . Glumae subaequales, lanceolatae, acuminatae"; and his wonderful plate (our PLATE 752) showed a characteristic plant of our species no. 2, even to the slenderly ellipsoid grain. The material cultivated by the Jacquins at Vienna was, then, like that sent to and cultivated by Linnaeus at Upsala and described by him as *Agrostis mexicana*. When he transferred *A. mexicana* to *Muhlenbergia*, Trinius, Gram. Unifl. 189 (1824) held the diagnostic characters of the Linnean species "Panicula contracta densiuscula; Glumis lineari-lanceolatis acutissimis subaequalibus perianthio acutissimo vix brevioribus". There seems to be no way to avoid taking up for the plant erroneously passing as *M. foliosa* the clearly described and typified M. MEXICANA (L.) Trin.

M. MEXICANA OF RECENT AUTHORS (PLATES 749 and 750)

When we consider the earlier available names for the plant recently but erroneously passing as *Muhlenbergia mexicana*, our species no. 1, the name seemingly available, if we accept current bibliographies, is *M. lateriflora* (Michx.) Trin. ex Kunth, Enum. i. 207 (1833) in synonymy of *Cinna lateriflora* Kunth, Rev. Gram. i. 67 (1829), both names based on *Agrostis lateriflora* Michx. Fl. Bor.-Am. i. 53 (1803) from rock-cliffs of the Mississippi and shores in [southern] Illinois. Michaux's description is not at all good for a plant with geniculate and bushy-branched stems, relatively large terminal panicles and long-awned glumes;

Photo. B. G. Schubert.

MUHLENBERGIA FRONDOSA: FIG. 1, characteristic decumbent branch, × ⅓; FIG. 2, characteristic glabrous internode, open and compressed sheath and partly included panicle, × 5; FIG. 3, portion of rhizome, × 4.

Photo. B. G. Schubert.

MUHLENBERGIA MEXICANA: FIG. 1, type of AGROSTIS MEXICANA, × ½; FIG. 2, portion of panicle of type, × 5; FIG. 3, spikelets, × 10.

and the photograph of the type sent me by M. Cintract is very inconclusive. The description was as follows:

LATERIFLORA. A. culmis erectis, nodosis: foliis linearibus, planis: paniculis lateralibus et terminalibus, pusillis, coarctatis, densifloris: glumae muticae et scaberulae valvis acutissimis; interioribus majoribus, basi barbulatis.

Hab. praesertim in praecipitibus saxosis fluminis *Missisipi* et ripariis Illinoensibus.

Authors immediately following Michaux seem not to have known the plant, Beauvois shifting it without discussion to *Vilfa*, and Kunth, likewise with no discussion, transferring it to *Cinna*. It was not until Kunth's Enumeratio that the plant, as *Cinna lateriflora* (Michx.) Kunth, with "Muehlenbergia lateriflora *Trin.*" as a synonym, was again accorded a diagnosis, that copied directly from Michaux. Michaux's erect culm, densely flowered small panicles and muticous glumes are not satisfactory for the common plant known as *M. mexicana*. The photograph is of mere fragments: broken-off tips of a stiffly ascending plant with long internodes; leaf-blades erect, only 2–4 mm. broad and long-tapering; the linear-filiform panicles only 1.5–4 mm. thick, with spikelets only 2.5–3 mm. long. These fragments look like small bits picked from a plant of *M. glabriflora* Scribn. Only Michaux's "glumae . . . interioribus . . . basi barbulatis" would seem to separate it from that species of dry or baked soils, gravels or rocky slopes, from southwestern Indiana (perhaps also Ohio) and Illinois to Texas. *M. glabriflora* is reputed to have the lemma glabrous. It would not now be justifiable to reduce *M. glabriflora* to *M. lateriflora;* when the florets can be actually studied that may be inevitable. In fact, Steudel, Synop. Pl. Gram. 182 (1854), describing in detail the species he took to be *Cinna lateriflora* (Michx.) Kunth, from Ohio plants of Frank's, said "glumis . . . subaequalibus . . . ; valvulis . . . glabris." It is, however, fairly clear that we can not properly take up *M. lateriflora* for the plant, no. 1, which has been passing as *M. mexicana*.

Another name, ignored or waved aside by recent American authors, needs consideration, for it is with little doubt the first name for species no. 1, the plant generally passing as *Muhlenbergia mexicana* and so passing for more than a century, the confusion dating back to botanists of a full century ago, when

nos. 1 and 2 were completely mixed in our floras, Torrey, Fl. N. Y. ii. 437, 438 (1843), for instance, saying "*M. foliosa* Trin. (*Agrostis filiformis*, Muhl. gram.) seems to be only a variety of this species", in which, unintentionally perhaps, he was correct, for, as I later show, the type of *Agrostis filiformis* is the form of true *M. mexicana* with awned lemmas. The species (*M. mexicana* sensu Torrey) with "Culm . . . much branched . . . often geniculate; sheaths compressed, loose . . . is sometimes troublesome in gardens", the latter points applying to species no. 1. The neglected name to which I refer is *Agrostis frondosa* Poir. in Lam. Encyc. Suppl. i. 252 (1790). The description, noting *flexuous stems, very leafy and compressed branches*, purplish nodes, *loose sheaths* and oblong and often purplish panicles suggesting those of *A. mexicana*, are all indicative of species no. 1. Here is Poiret's account, he giving the name because of the leafiness of the plant:

46. AGROSTIS feuillé *Agrostis frondosa.*

Agrostis culmo flexuoso, articulis ramosis, foliosis; paniculis coarctatis; calicibus acutis, corollâ brevioribus. (N.)

Ses tiges sont hautes d'un à deux pieds, glabres, un peu flexueuses à leurs articulations: de chacune de ces articulations il sort des rameaux feuillés, comprimés, également flexueux, & souvent de couleur purpurine au dessous des noeuds. Les feuilles sont glabres, courtes, nombreuses; leur gaîne lâche, nue à son orifice, munie d'une petite membrane blanche. Les panicules sont étroites, serrées, assez semblables à celles de l'*agrostis mexicana;* les ramifications en forme d'épis oblongs, de couleur verte, un peu purpurine; les fleurs petites, oblongues; les valves calicinales plus courtes que celles de la corolle, aiguës, mucronées à leur sommet; celles de la corolle étroites, oblongues, aiguës.

Cette plante croît en Allemagne. (*V. s. in herb. Desfont.*)

Although it was supposed that *Agrostis frondosa* came from Germany, the name was completely disregarded in the great German floras of Gmelin, Koch and others of their period; nor does it have any recognition in the more modern and voluminous treatments by Ascherson & Graebner and by Hegi. The source, like that of so many species early reaching European collections, was evidently misunderstood, as was that of *A. mexicana* of Linnaeus, Jacquin and others. Nevertheless, the weedy tendency of species no. 1 evidently enabled it to reach Europe somewhat after Poiret's time. For instance, Lejeune & Courtois, Comp. Fl. Belg. i. 61 (1828) refer to *A.* "*mexicana*" having been collected in Belgium, "e semine exotico orta"; and Hegi, Ill. Fl.

Mittel-Eur. vii. 154 (1931), refers to the recent occurrence in Germany of *M.* "*mexicana.*" Whether these are true *M. mexicana* ("*foliosa*") or the very different plant (our no. 1) which generally passes as *M. mexicana* I can not now determine.

But, returning to *Agrostis frondosa* Poir. Roemer & Schultes, Syst. ii. 373 (1817) made it an exact synonym of their newly defined *A. foliosa*, saying "certissime huc spectat". Steudel, who certainly understood grasses, treated it unequivocally in his Nomenclator, ed. 2: 365 (1840) as identical with various plants now placed under *Muhlenbergia* (including *M. foliosa*, etc., but not *M. mexicana*, which Steudel retained in the true sense). Hooker filius & Jackson in Index Kewensis, placed it, also without question, in the all-inclusive *M. mexicana* of their period. As already noted, Poiret's "culmo flexuoso . . . de chacune de ces articulations il sort des rameux feuillés, comprimés, également flexueux . . . Les feuilles . . . nombreuses; leur gaîne lâche, . . . Les panicules . . . les ramifications en forme d'épis oblongs" are reasonably good characterizations of our common so-called *M. mexicana;* no other species involved in the problem has *lax* and *compressed* sheaths. I am, therefore, subject to verification when the type can be studied, identifying *M. mexicana* of recent authors with AGROSTIS FRONDOSA Poiret.

The name *Muhlenbergia foliosa* (Roemer & Schultes) Trin. Gram. Unifl. 196 (1824) rests for typification upon *Agrostis foliosa* Roem. & Schultes, Syst. Veg. ii. 373 (1817). As currently treated *M. foliosa* is an erect plant with few erect branches; scabrous-puberulent internodes; firm ascending leaves; "panicles mostly exserted, often rather long-exserted, narrow, of numerous short appressed densely flowered somewhat aggregate branches" (*Hitchcock*), the branches densely flowered to base; the spikelets subsessile or short-pedicelled; glumes subequal and subulate-tipped (only rarely definitely awned), firm and herbaceous; the usually awnless lemma of similar texture; the mature florets tardily dropping and tightly embracing the slenderly ellipsoid grain (1.3–1.6 mm. long), the plant, my no. 2, which I identify with *M. mexicana* in the strict sense. Roemer & Schultes evidently supposed that Poiret's *Agrostis frondosa* was the plant in cultivation under the equivalent name, *A. foliosa*, and their glumes unequal, with hispid awns ("calycibus inaequalibus aris-

tatis hispidis") might well have been derived from *A. frondosa;* but their lemma and palea unequal, the former awned at tip and the culm much branched, erect ("corollis . . . inaequalibus valvulâ majore apice aristata, culmo ramosissimo erecto") suggest *M. sylvatica!* Roemer & Schultes had two varieties: "α. paniculis viridibus" to which they assigned *A. filiformis* Willd.; and "β. paniculis rubicundis" to which they assigned *A. frondosa* Poir. The latter has already been discussed.

The two subdivisions of their *Agrostis foliosa* were borrowed in part from Willdenow, who had described, also from cultivated plants, *A. filiformis* Willd. Hort. Bot. Berol. i. 95 (1809); but without including in it *A. frondosa* Poir.

*6. AGROSTIS *filiformis*.
A. panicula coarctata subspicata, calycibus aristatis inaequalibus hispidis, corollis calyce majoribus inaequalibus valvula majore apice aristata, culmo ramosissimo erecto.
α. paniculis viridibus.
β. paniculis rubicundis.
Agrostis foliosa *Hortulanorum.*
Habitat in America *boreali.* ♃. D.
A Polypogone diversa calycibus corolla brevioribus. Habitu accedit ad A. mexicanam, sed calycibus, corollis, inflorescentia tenuiore, et florescentia serotina diversa. Varietas β robustior.

A photograph of Willdenow's type of *Agrostis filiformis*, most kindly presented to me by Professor Diels, shows the slenderest extreme of *Muhlenbergia mexicana*, the plant usually passing as *A. foliosa;* but the awns at the tips of the lemmas show that it is the form known as *A. foliosa*, forma *ambigua* (Torr.) Wieg. The exact identity of the plants of Roemer & Schultes must await opportunity to study them. In the mean time, however, the very liberal fragments of what was taken as the type of Roemer & Schultes have been sent me from the National Herbarium at Washington for study. Portions of this material are reproduced as PLATE 749, FIGS. 1, 2 and 3. They certainly belong to the species which has erroneously passed as *M. mexicana;* and since the name *Agrostis foliosa* Roemer & Schultes was nomenclaturally a substitute for *A. frondosa* Poir. and, therefore, illegitimate, it is fortunate that the Roemer & Schultes type belongs so unequivocally to the species which I take to be *A. frondosa* of Poiret.

Photo. B. G. Schubert.

MUHLENBERGIA MEXICANA: FIG. 1, Jacquin's plate of AGROSTIS MEXICANA, × ⅖; FIG. 2, summit of puberulent and opaque internode and node and base of sheath, × 5, from Massachusetts; FIG. 3, floret, × 10, from Quebec; FIG. 4, grain, × 10, from New Jersey.

Photo. B. G. Schubert

MUHLENBERGIA RACEMOSA: FIG. 1 (2 branches), type of *Agrostis racemosa*, × ½; FIG. 2, panicle, × 1, from Illinois; FIG. 3, panicle, × 1, from Illinois; FIG. 4, spikelet, × 10, from Minnesota; FIG. 5, floret, × 10, from Minnesota; FIG. 6, grain, × 10, from Illinois.

M. sylvatica

Muhlenbergia sylvatica Torr. is, apparently, correctly understood! A northeastern variety of it will be published on a succeeding page.

M. racemosa (Plates 753 and 754)

Muhlenbergia racemosa (Michx.) BSP., on the other hand, has been quite misinterpreted. This misinterpretation arose through the fact that most specimens reaching the European herbaria and the plant best known to botanists of Cambridge, New York and Washington is the very different *M. setosa* (Spreng.) Trin., with erect, slender and usually simple culms with scabrous-puberulent internodes, typical of bogs, wet meadows and shores and doubtless suggesting to the manufacturer of "English" names the pseudonym "Marsh Muhly", commented upon on p. 222. *Agrostis racemosa* Michx., basis of the very recent and by its authors not understood combination *M. racemosa* (Michx.) BSP. Prelim. Cat. N. Y. 67 (1888), "Presumably based on *Agrostis racemosa* Michx." (*Hitchcock*), is a wholly different species of the interior of the continent and almost unknown in herbaria prior to 1850. It was finally recognized as *M. glomerata*, var. *ramosa* Vasey, Descr. Cat. Grasses U. S. 40 (1886) but Vasey did not see the really distinctive characters.

Muhlenbergia setosa (or *glomerata*) has the culms unbranched or with few erect basal branches; opaque and scabrous-puberulent internodes; leaf-sheath with rounded midrib and minute usually hidden ligule; conspicuous anthers 1–1.5 mm. long; oblong-cylindric grain easily freed and 1.2–1.5 mm. long; the species with transcontinental boreal range and intrusions southward, east and west, in paludal habitats. *M. racemosa*, on the other hand, is a plant of the dry interior, often "in the dryest of soil", with culms usually stiffly branched at the middle nodes; the internodes lustrous and glabrous; the leaf-sheath keeled; the ligule prolonged; the anthers only 0.5–0.8 mm. long; the tightly embraced linear-cylindric grain 1.8–2.2 mm. long.

Michaux's original description was too general to note any of the specific points, and his habitat, "in ripis sabulosis inundatis fluminis *Missisipi*" inconclusive. The photograph of the type before me shows, however, the high-branching culm and the

characteristic stiffly glomerulate-spiciform panicles of *M. glomerata*, var. *ramosa;* and examination by me of the Michaux specimens in 1930 revealed the glabrous internodes and tiny anthers. The name *Muhlenbergia racemosa* (Michx.) BSP. should be restricted to the plant of the interior later described as *M. glomerata*, var. *ramosa*.

M. SETOSA (PLATES 755–757)

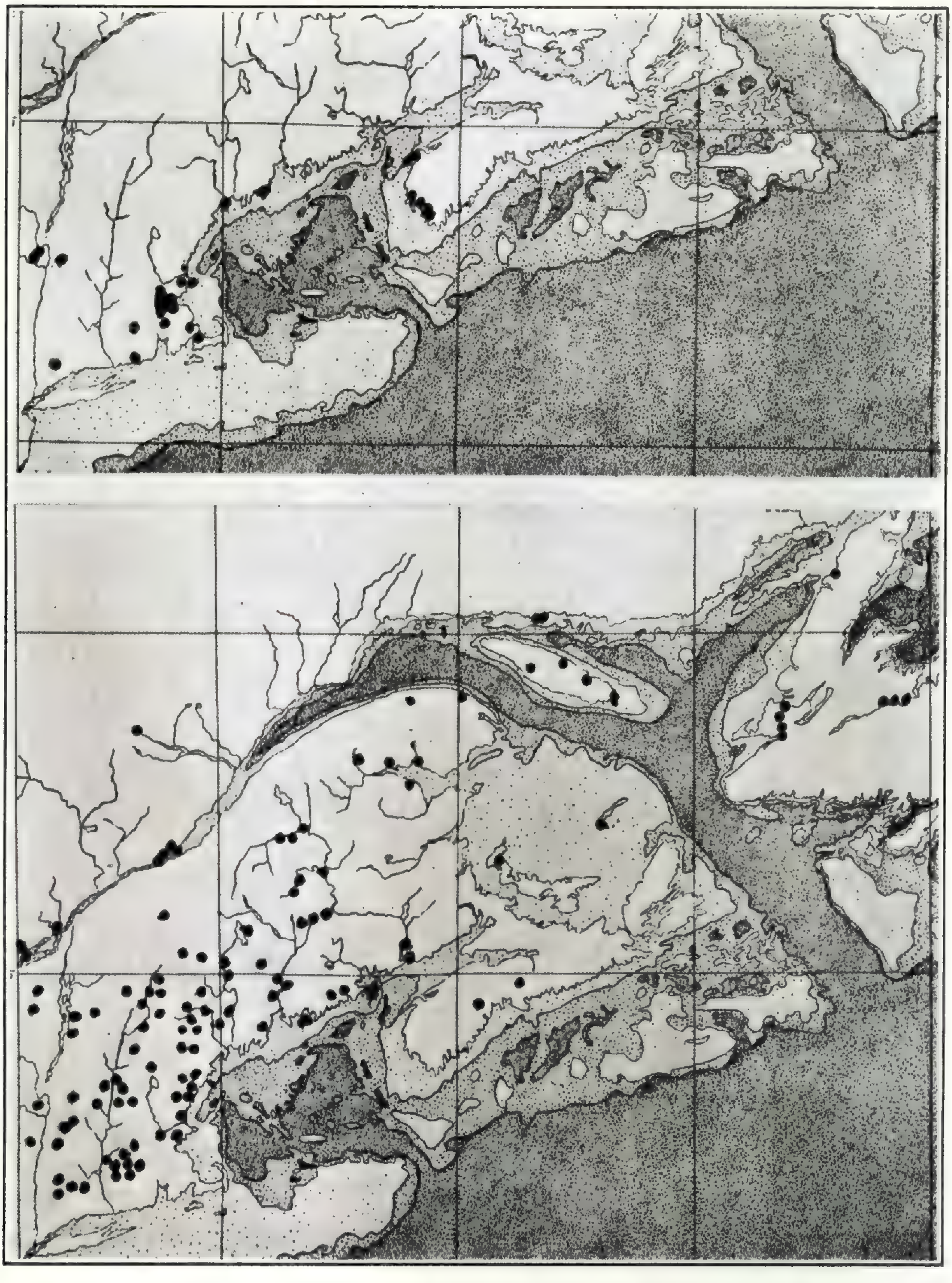
Muhlenbergia glomerata (Willd.) Trin. Gram. Unifl. 191, pl. 5, fig. 10 (1824) rests upon *Polypogon glomeratus* Willd. Enum. Pl. 87 (1809), which was described in great detail, the simple diagnosis and accompanying statements being

> *2. POLYPOGON *glomeratus*.
> P. panicula glomerata subspicata, calycibus subulatis scabris, culmo adscendente basi ramoso.
> Agrostis festucoides *Mühlenberg in litt.*
> *Habitat in* America *boreali* ♃. D.

Since the plant was received from Muhlenberg, it presumably came from eastern Pennsylvania. The very long description following the diagnosis may be abbreviated.

> "*Folia* rigidiuscula . . . *Ligula* brevissima . . . *Vaginae* foliorum solutae. *Panicula* glomerato-spicata obtusiuscula, ramis brevissimis adpressis flexuosis . . . *Calyx* . . . aristatus corolla longior, nervo medio viridi, una cum arista scabro . . . Basis corollae pilis aliquot est instructa . . . Habitu accedit quodammodo ad Agrostidem mexicanam, sed recedit ab hoc genere calyce aristato, et est vera Polypogonis species."

The type, for a photograph (our PLATE 756, FIG. 1) of which I am indebted to Professor Diels, consists of four plants of the characteristic species (MAP 1) growing in bogs and wet meadows from western Nova Scotia and southern Maine to southern Ontario and Michigan, south to southern New England, northern New Jersey, Pennsylvania, mountains to North Carolina, and Indiana. There is no question about the identity of *Muhlenbergia glomerata;* but a second plant (MAP 2), also of simple habit or branched usually from the base, with puberulent internodes, large anthers and short grains, occurs farther north, from Newfoundland to Alberta, south to Nova Scotia and Maine, northern Massachusetts, Connecticut, New York, central Pennsylvania, Ohio, Michigan, Wisconsin, Minnesota, Wyoming, Nevada and Oregon. This is *Dactylogramma cinnoides* Link, Hort. Berol. ii.



MAP 1 (upper), eastern Range of MUHLENBERGIA SETOSA; MAP 2 (lower), of M. SETOSA, var. CINNOIDES.

248 (1833), described in great detail from plants raised from seed from northwestern Canada sent by Dr. John Richardson. The genus *Dactylogramma* Link was based on this material, Link separating it from *Cinna*. From the very full description the following points are drawn:

"Caulis erectus parum ramosus . . . Panicula tenuis glomerata. Valvae subaequales longissime acutatae quasi aristatae, glumella longiores. Valvulae . . . pilis longis adpressis ad marginem . . . Caulis sub terra repens, 2–3 pedes altus . . . inferne pilis brevissimis pubescens . . . ligula brevis truncata. Panicula 2–4 poll. longa, ramis subdistantibus brevissimis superne approximatis, ramulis conglomeratis."

The description is vivid; the photograph (our PLATE 757, FIG. 1) of Link's type sent me by Professor Diels unequivocal.

The more northern *Dactylogramma cinnoides* differs in several characters from the relatively southern *Muhlenbergia glomerata*. In the latter the flowering culms bear 7–15 leaves, many of them often crowded and overlapping at the middle nodes; in the former there are 5–8 (rarely –10) more scattered leaves. In *M. glomerata* the panicle, as correctly defined by Willdenow, has round-tipped spikes mostly crowded to form a subcontinuous lobulate-spiciform inflorescence; in *D. cinnoides* the spikes or branches, except the upper, are more scattered or subdistant and less rounded at summit. In *M. glomerata* the inflorescence is often purplish, sometimes green; in *D. cinnoides* green, though sometimes purplish. The panicle of *M. glomerata* has a misty appearance, the awns and glumes not sharply visible. This comes from the copiously hispid keels and awns. In *D. cinnoides* the panicle has the glumes and awns more clearly visible, the keels and awns being merely scabrous with definitely shorter trichomes. These differences, with no appreciable difference in anthers and grains, seem to me varietal, rather than specific, and I am treating *D. cinnoides* as a northern geographic variety of the more southern plant.

Unfortunately, however, there is an earlier valid specific name for true *Muhlenbergia glomerata* (Willd.) Trin., which was based on *Polypogon glomeratus* Willd. (1809). This is *Polypogon setosus* Spreng. Mant. Fl. Hal. 31 (1807). That it is specifically identical with the Muhlenberg material which formed the basis of Willdenow's species is clear from the description; the photo-

Photo. B. G. Schubert.

MUHLENBERGIA RACEMOSA: FIG. 1, characteristic summit of plant, × 1, from Minnesota; FIG. 2, summit of glabrous and lustrous internode and node and base of sheath, × 5, from Wisconsin; FIG. 3, portion of paniele to show characteristic small anthers, × 4, from Illinois.

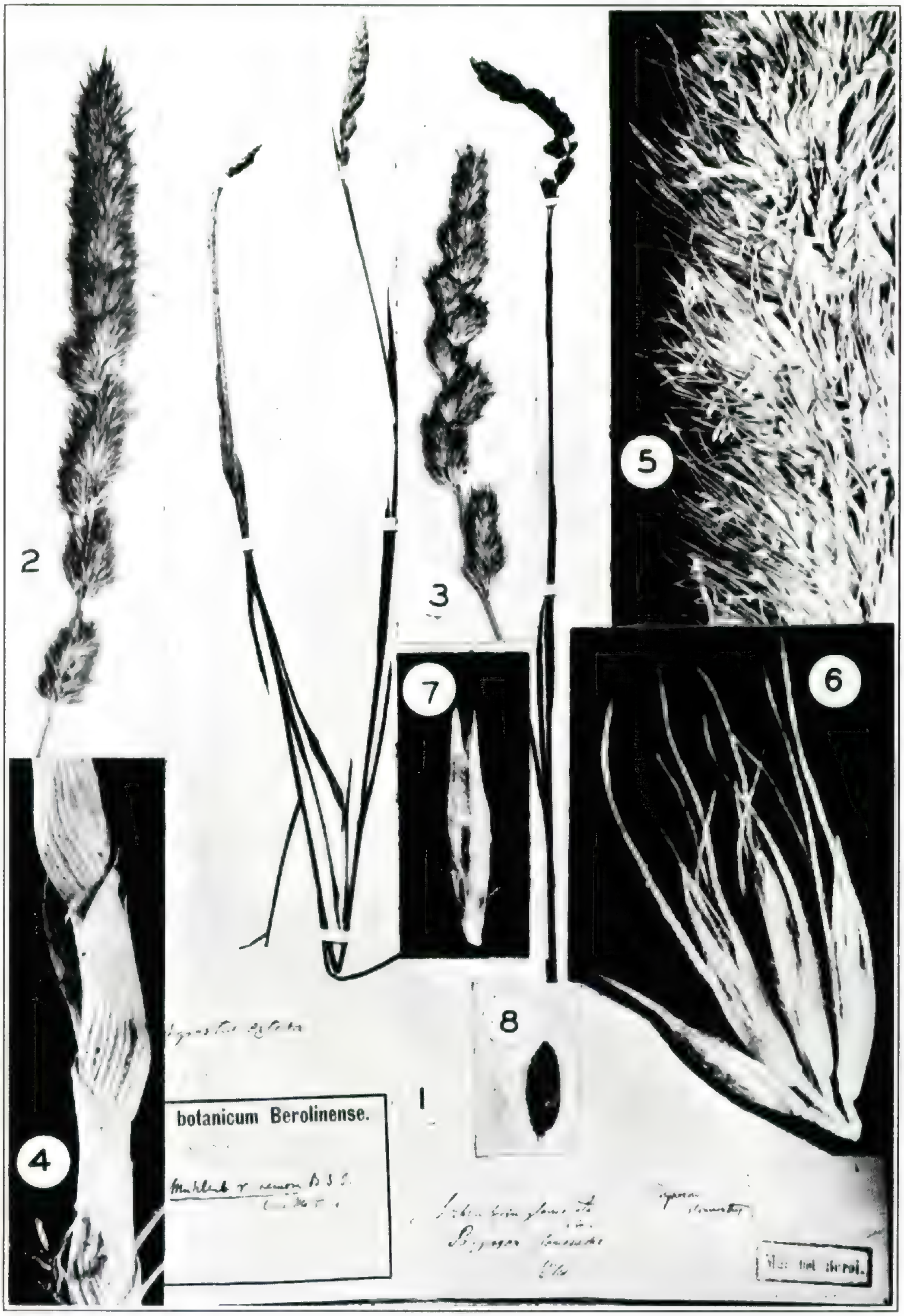


Photo. B. G. Schubert.

MUHLENBERGIA SETOSA: FIG. 1, type of POLYPOGON SETOSUS, × ⅓; FIG. 2, panicle, × 1, from Massachusetts; FIG. 3, panicle, × 1, from Pennsylvania; FIG. 4, portion of rhizome, × 4, from Nova Scotia; FIG. 5, portion of panicle to show characteristic long anthers, × 4, from Massachusetts; FIG. 6, spikelets, × 10, from Massachusetts; floret showing basal villi, × 10, from Pennsylvania; FIG. 8, grain, × 10, from Pennsylvania.

graph of Sprengel's type (our PLATE 755, FIG. 1), for which I am also indebted to Professor Diels, is certainly of the plant of eastern Pennsylvania. Sprengel's description was to the point:

> 9. POLYPOGON SETOSUS, panicula spicaeformi, glumis acuminatis aristatis scabris, foliis involutis rigidis.
>
> *Culmus* teres, glaber, foliosus, pedalis. *Folia* glabra, vaginantia, involuta, rigida. *Panicula* terminalis, parumper ex ultimo folio emergens, fusca, densè spicaeformis, ramulis glomeratis contractis. *Gluma* calycina valvulis acuminatis scabris aristatis, uniflora, corolla paullo maior. *Gluma* corallina valvulis acuminatis muticis.
>
> E Pensylvania. *Muhlenb.*

In his De Graminibus Unifloris et Sesquifloris, 195 (1824), after properly transferring several species to *Muhlenbergia*, Trinius took a short cut and merely stated that certain species belonged to that genus: "Ad sectionem *a* (*Mühlenbergiam*) pertinent: . . . Polypogon setosus *Spreng.*", but the combination, ascribed to Trinius at this place and with the correct synonym, *M. glomerata*, was made in Index Kewensis. The species with culms simple or sparingly branched at base and with scabrous-puberulent internodes, large anthers and small grains is, then, M. SETOSA (Spreng.) Trin. ex Hook. f. & Jackson, Ind. Kew. ii. 209 (1894).

Summarizing this rather verbose but seemingly necessary discussion, the five species of *Muhlenbergia* specially considered resolve themselves as follows (omitting *M. sylvatica* which, except for the designation of a variety, is unchanged). In order to clarify the complex questions I am reproducing photographs of types in so far as they are before me and sufficiently clear for reproduction. These I am supplementing by some of Dr. Bernice G. Schubert's very clear enlargements of pertinent details.

MUHLENBERGIA **frondosa** (Poir.), comb. nov. *Agrostis frondosa* Poir. in Lam. Encyc. Suppl. i. 252 (1790). *A. foliosa* Roem. & Schultes, Syst. ii. 373 (1817), substitute-name for *A. frondosa*. *M. foliosa* (Roem. & Schultes) Trin. Gram. Unifl. 196 (1824), not recent auth. *M. mexicana* sensu most recent auth., not (L.) Trin.—For diagnostic characters see no. 1 in key. PLATES 749 and 750.

M. FRONDOSA, forma **commutata** (Scribn.), comb. nov. *M. mexicana commutata* (as subsp.) Scribn. in RHODORA, ix. 18 (1907), at least as to TYPE, *Fernald*, no. 522, designated by Hitchc. Man. 890 (1935), where Scribner's trinomial "n. subsp." is cited as "var." *M. mexicana*, var. *commutata* (Scribn.) Farwell in Rep. Mich. Acad. Sci. xvii. 181 (1916). *M. commutata*

(Scribn.) Bush in Am. Midl. Nat. vi. 61 (1919). *M. mexicana*, forma *commutata* (Scribn.) Wiegand in Rhodora, xxvi. 1 (1924).

M. mexicana (L.) Trin. Gram. Unifl. 189 (1824). *Agrostis mexicana* L. Mant. i. 31 (1767); Jacq. f. Eclog. Pl. Rar.-Gram. Fasc. ter. et quart. 44, t. 30 (1813). For other synonyms based on *A. mexicana* see Hitchcock. *M. foliosa* sensu most recent auth., not (R. & S.) Trin. For diagnostic characters see no. 2 in key. Plates 751 and 752.

M. mexicana forma **ambigua** (Torr.), comb. nov. *Agrostis filiformis* Willd. Enum. i. 95 (1809). *Cinna filiformis* (Willd.) Link, Enum. i. 70 (1821). *Agrostis lateriflora*, var. *filiformis* (Willd.) Torr. Fl. N. Mid. U. S. 86 (1823). *M. ambigua* Torr. in Nicollet, Rep. Miss. 164 (1843). *M. mexicana filiformis* (Willd.) Scribn. in Mem. Torr. Bot. Cl. v. 36 (1894). *M. foliosa ambigua* (Torr.) Scribn. in Rhodora ix. 20 (1907). *M. ambigua*, var. *filiformis* (Willd.) Farwell in Mich. Acad. Sci. Rep. xx. 168 (1919). *M. foliosa*, forma *ambigua* (Torr.) Wiegand in Rhodora, xxvi. 1 (1924).

M. mexicana, forma **setiglumis** (S. Wats.), comb. nov. *M. sylvatica*, var. *setiglumis* S. Wats. in King, Geol. Expl. 40th Paral. v. 378 (1871). *M. foliosa setiglumis* (S. Wats.) Scribn. in Rhodora, ix. 20 (1907). *M. setiglumis* (S. Wats.) Nels. & Macbr. in Bot. Gaz. lxi. 30 (1916).

M. sylvatica Torr., var. **robusta,** var. nov., culmis rigidis arcte adscendentibus; foliis firmis ad 5–9 mm. latis; paniculis densioribus; glumis late lanceolatis vel lanceolato-ovatis; lemmatibus 3–4 mm. longis longe aristatis; antheris 0.5–0.7 mm. longis; caryopsibus 1.9–2.1 mm. longis.—Open woods and thickets, central Maine to western New York and eastern Pennsylvania. The following are characteristic. Maine: Austin Stream, Moscow, August 27, 1902, *Collins & Chamberlain;* Sydney, August 18, 1916, *Fernald & Long*, no. 12,597 (type in Herb. Gray). New Hampshire: by Merrimac River below Bedford, August 27, 1931, *Fernald & Griscom*, no. 2495; Gilsum, August 9, 1899, *Fernald*, no. 287; Wilton, August 15, 1916, *C. F. Batchelder*. Vermont: Grand Isle, July 24, 1935, *Knowlton*. Massachusetts: Needham, August 31, 1884, *T. O. Fuller;* Blue Hills Reservation, September 22, 1895, *E. F. Williams;* Huntington, August 17, 1912, *Robinson*, no. 358. Rhode Island: Lincoln, October 2, 1910, *E. F. Williams*. Connecticut: Sprague, September 1, 1905, *Woodward;* Reynold's Bridge, September 4, 1910, *Blewitt;* Bridgeport, September 22, 1896, *Eames*. New York: Starbuckville, August 26, 1932, *Muenscher & Lindsey*, no. 2954; Genoa, August 21, 1918, *Wiegand*, no. 9185; Ithaca, September 5, 1916, *F. P. Metcalf*, no. 5613; Butler, October 5, 1916, *Metcalf & Wright*, no. 5614. Pennsylvania: Wayne, October 15, 1910, *Bartram*, no. 1313.

Typical *Muhlenbergia sylvatica* has relatively weak and loosely ascending culms; the leaves subflaccid, the larger ones 2–7 mm. wide; the panicle very loose; the glumes linear-lanceolate to linear-attenuate, the 2d about equaling to slightly exceeding the blade of the lemma, the latter 2.3–3 mm. long; the anthers 0.3–0.6 mm. long; the mature grain nearly or quite free, 1.4–1.8 mm. long. It is widely distributed, from southwestern Quebec to Minnesota, south to North Carolina, Alabama, Arkansas and northeastern Texas.

Var. *robusta* is stiffer and larger in all parts. Its leaves are firm and more ascending, the larger ones 5–9 mm. broad; the panicle fuller; glumes broadly lanceolate to lance-ovate, shorter than the blade of the lemma, the latter 3–4 mm. long; anthers 0.5–0.7 mm. long; grain more firmly embraced and 1.9–2.1 mm. long.

M. RACEMOSA (Michx.) BSP. Prelim. Cat. N. Y. 67 (1888), by inference. *Agrostis racemosa* Michx. Fl. Bor.-Am. i. 53 (1803). *Polypogon racemosus* (Michx.) Nutt. Gen. i. 51 (1818). *Cinna racemosa* (Michx.) Kunth, Rév. Gram. i. 67 (1829). *M. glomerata*, var. *ramosa* Vasey, Descr. Cat. Grasses U. S. 40 (1885). *M. racemosa*, var. *ramosa* Vasey in Beal, Grasses N. Am. ii. 253 (1896). For diagnostic characters see no. 4 in key. PLATES 753 and 754.

M. SETOSA (Spreng.) Trin. ex Hook. fil. & Jackson, Ind. Kew. iii. 209 (1894). *Polypogon setosus* Spreng. Mant. Fl. Hal. 31 (1807). *P. glomeratus* Willd. Enum. 87 (1809). *Alopecurus glomeratus* (Willd.) Poir. in Lam. Encycl. v. 495 (1817). *Agrostis setosa* (Spreng.) Muhl. Descr. Gram. 68 (1817). *Trichochloa glomerata* Trin. Fund. Agrost. 117 (1820). *T. calycina* Trin. l. c. (1820). *M. glomerata* (Willd.) Trin. Gram. Unifl. 191, pl. 5, fig. 10 (1824). *M. calycina* Trin. l. c. 193 (1824). *Podosaemum glomeratum* (Willd.) Link, Hort. Berol. i. 84 (1827). *Cinna glomerata* (Willd.) Link, l. c. ii. 237 (1833). For specific characters see no. 5 in key.—Typical *M. setosa* has the leaves of flowering culms 7–15, many of them often browded and overlapping at the middle nodes; panicle purplish, fuscous or green, with all but the lowest of the densely flowered ellipsoid to rounded-obovoid branches closely crowded, the panicle thus appearing densely lobulate-spiciform; keel and awns of glumes copiously hispid, thus giving the inflorescence a "misty" aspect.—Meadows, bogs and wet shores, western Nova Scotia and southern Maine to southern Ontario and Michigan, south to southern New England, northern New Jersey, Pennsylvania, mountains to North Carolina, and Indiana. PLATES 755 and 756; MAP 1.

Var. **cinnoides** (Link), comb. nov. *Dactylogramma cinnoides* Link, Enum. Hort. Berol. ii. 248 (1833).—Differing from typical *M. setosa* in having fewer (5–8, rarely –10) and usually more scattered leaves; panicle usually green, rarely purple-tinged, usually more interrupted, the cylindric to oblong-ovoid often subacute lower branches often remote; glumes slightly broader, with merely scabrous keel and awn (the panicle, therefore, not appearing "misty").—Similar habitats, Newfoundland to Alberta, south to Nova Scotia, northern Massachusetts, Connecticut, New York, central Pennsylvania, Michigan, Wisconsin, Minnesota, Wyoming, Nevada and Oregon. PLATE 757; MAP 2.

PLATE 749. MUHLENBERGIA FRONDOSA (Poir.) Fern.: FIGS. 1, 2 and 3, fragments from TYPE of *Agrostis foliosa* Roem. & Schultes, × 5, from portions of type in Herb. U. S. Nat. Mus., kindness of Mr. *Jason R. Swallen;* FIG. 4, two spikelets, × 4, from Bridgeport, Connecticut, September 7, 1893, *Eames;* FIG. 5, floret, × 10, from Shirley, Massachusetts, October 4, 1914, *J. R. Churchill;* FIG. 6, grain, × 10, from last specimen.

PLATE 750. MUHLENBERGIA FRONDOSA (Poir.) Fern.: FIG. 1, a characteristic decumbent branch, × ⅓, from East Jaffrey, New Hampshire, *B. L. Robinson,* no. 395; FIG. 2, characteristic glabrous internode, open and compressed sheaths and partly included axillary panicle, × 5, from Stratford, New Hampshire, *Pease,* no. 23,921; FIG. 3, portion of rhizome, × 4, to show cucullate-arching scales, from no. 23,921.

PLATE 751. MUHLENBERGIA MEXICANA (L.) Trin.: FIG. 1, TYPE of AGROSTIS MEXICANA L., basis of the species, × ½, from Herb. Linn., kindness of the late Dr. *B. Daydon Jackson;* FIG. 2, portion of panicle of TYPE, × 5, from fragment in Herb. U. S. Nat. Mus., kindness of Mr. *Jason R. Swallen;* FIG. 3, two spikelets, × 10, from Lanoraie, Quebec, *Victorin & Rolland,* no. 29,030.

PLATE 752. MUHLENBERGIA MEXICANA (L.) Trin.: FIG. 1, plate of Jacquin f., × ⅖; FIG. 2, portion of opaque and puberulent internode and node and base of sheath, × 5, from Worthington, Massachusetts, *B. L. Robinson,* no. 649; FIG. 3, floret, × 10, from St.-Hubert, Quebec, *Victorin & Rolland,* no. 33,968; FIG. 4, grain, × 10, from shore of Delaware River, Sussex County, New Jersey, September 15, 1917, *E. B. Bartram.*

PLATE 753. MUHLENBERGIA RACEMOSA (Michx.) BSP.: FIG. 1, TYPE (two pieces) × ½, of *Agrostis racemosa* Michx., basis of species, from Herb. Michaux, Paris, kindness of Professor *Humbert;* FIG. 2, panicle, × 1, from Menard County, Illinois, 1861, *E. Hall;* FIG. 3, panicle, × 1, from near Princeville, Peoria County, Illinois, *V. H. Chase,* no. 940; FIG. 4, spikelet, × 10, from Fort Snelling, Minnesota, *Mearns,* no. 747; FIG. 5, floret, showing basal villi, × 10, from no. 747; FIG. 6, grain, × 10, from near Oquawka, Illinois, *Patterson.*

PLATE 754. MUHLENBERGIA RACEMOSA (Michx.) BSP.: FIG. 1, a characteristic summit of a plant, × 1, from Fort Snelling, Minnesota, *Mearns,* no. 747; FIG. 2, summit of glabrous and lustrous internode and node and base of sheath, × 5, from La Crosse, Wisconsin, 1861, *T. J. Hale;* FIG. 3, portion of panicle, × 4, to show the small anthers, from near Princeville, Peoria County, Illinois, *V. H. Chase,* no. 940.

PLATE 755. MUHLENBERGIA SETOSA (Spreng.) Torr.: FIG. 1, TYPE of *Polypogon setosus* Spreng., basis of the species, × ca. ⅓, from Herb. Berol., kindness of Professor *Diels;* FIG. 2, panicle, × 1, from Walpole, Massachusetts, September 7, 1896, *J. R. Churchill;* FIG. 3, panicle, × 1, from northwest of Pleasant Valley, Bucks County, Pennsylvania, September 15, 1923, *Benner;* FIG. 4, portion of rhizome, to show appressed scales, × 4, from west of Centreville, Digby County, Nova Scotia, *Graves & Linder,* no. 19,865; FIG. 5, portion of panicle, × 4, to show long anthers, from Walpole, Massachusetts, September

2, 1883, *Walter Deane;* FIG. 6, group of spikelets, × 10, from Muddy Pond, West Roxbury, Massachusetts, *C. E. Faxon;* FIG. 7, floret, × 10, showing few slender basal villi, from Mt. Bethel, Northampton County, Pennsylvania, October 4, 1908, *Van Pelt;* FIG. 8, grain, × 10, from the last (*Van Pelt*) specimen.

PLATE 756. MUHLENBERGIA SETOSA (Spreng.) Trin.: FIG. 1, TYPE of *Polypogon glomeratus* Willd., basis of *M. glomerata* (Willd.) Trin., × ⅓, from Herb. Willdenow, kindness of Professor *Diels;* FIG. 2, opaque and puberulent internode and node and base of sheath, × 5, from northwest of Pleasant Valley, Bucks County, Pennsylvania, September 15, 1923, *Benner*.

PLATE 757. MUHLENBERGIA SETOSA (Spreng.) Trin., VAR. CINNOIDES (Link) Fern.: FIG. 1, TYPE of *Dactylogramma cinnoides* Link, basis of the variety, × ca. ⅓, from Herb. Berol., kindness of Professor *Diels;* FIG. 2, panicle, × 1, from Grand Falls, Newfoundland, *Fernald & Wiegand*, no. 4531; FIG. 3, portion of panicle, to show elongate anthers (as black lines), × 4, from Fort Kent, Maine, August 21, 1913, *R. W. Woodward;* FIG. 4, floret, to show villi running high on lemma, × 10, from no. 4531; FIG. 5, grain, × 10, from River Ste. Anne des Monts, Gaspé County, Quebec, August, 1905, *Collins & Fernald*.

II. NOTES ON DANTHONIA

The two common species of *Danthonia* in eastern Canada, New England and New York are in general well defined, although the conventional differential characters of the lemma used by Hitchcock in Gray's Manual, ed. 7, and by Nash in Britton & Brown's Illustrated Flora are essentially valueless. As expressed by Hitchcock these are:

> "Teeth of the lemma triangular, not aristate.....1. *D. spicata.*
> Teeth of the lemma aristate.
> Flowers not over 5 mm. long.....2. *D. compressa.*"

Under the specific treatments the lemmas of *D. spicata* are said to be "4–5 mm. long, sparsely clothed with stiff hairs, *teeth triangular*", while *D. compressa* has the "*teeth of the lemma aristate, at least 2 mm. long.*" In practice this character so frequently breaks that it has been abandoned by later authors, and in his Manual Hitchcock relies upon the contracted panicle and relatively short blades of *D. spicata* as contrasted with the more open panicle and longer leaves of *D. compressa.*

The best key I have seen is that of Wiegand & Eames in their Flora of the Cayuga Lake Basin. For wholly typical *D. spicata* and *D. compressa* it is satisfactory; the difficulty is that so much material is not typical. In the series which everyone would accept as *D. spicata* in the broad sense, the lemma varies from 2–6.5 mm. long and its back may be densely pilose, sparingly pilose, strigose or quite glabrous, its teeth from broadly triangular to lance-attenuate and awnless or awned. Such variation is

largely without apparent geographic limit, though two well defined geographic varieties, var. *pinetorum* Piper and var. *longipila* Scribn. & Merr., are strongly marked; the former boreal and transcontinental, with lemmas often so large as to be mistaken for those of *D. intermedia* Vasey; the latter with the shortest lemmas of the series and a definitely southern range. The sheaths and blades of any of the variations may be glabrous, sparingly pilose or even long-villous; and to the latter tendency, without checking the original account, has been erroneously applied the name var. *longipila*. If forms of the common northern plant with pubescent foliage are to be distinguished, they have an earlier name, evidently intended for them, in *D. spicata*, var. *villosa* Peck (1894).

My chief reason for now publishing this note is to direct attention to a complex series of very large plants which in some ways stand between *Danthonia spicata* and *D. compressa* but which, in extreme development, have been mistaken for the southeastern *D. sericea* Nutt. These are the coarse midsummer- or autumn-flowering plants with stout culms up to 1 m. high; long, stiff and mostly erect basal leaves; panicle as in *D. spicata* but with more numerous and larger spikelets; glumes up to 2.5 cm. long; and lemmas up to 6.5 mm. long; these and the long glumes often leading collectors to place New England specimens with the more southern *D. sericea*. In this complex and mostly northern coarse series the culms may be terete to base, as in *D. spicata*, or the lower internodes may be trigonous or laterally compressed and with the narrower side broadly concave, as in *D. compressa*. The uppermost leaf may be short and remote from the long-exserted panicle, as in *D. spicata*, or (even from the same root) prolonged and reaching or overtopping the panicle as in *D. compressa*. The twisted base of the awn may be dark brown to purplish, as in *D. spicata*, or stramineous or pale, as in *D. compressa*. The panicle is more like that of *D. spicata* but large and dense. Furthermore, whereas *D. spicata* (typical) flowers in New England from late May to early July and *D. compressa* in June and July, the coarse plant flowers chiefly from August to October. If culms with trigonous to compressed lower internodes be selected they will belong to *D. Alleni* Austin (1872), while other culms (often in the same tussock), with the inter-

nodes terete, will be *D. Faxoni* Austin (1877). It might be assumed that *D. Alleni* (including *D. Faxoni*) is a series of hybrids, with unusual hybrid vigor; but it is found to the northeast of the limit of *D. compressa*, while to the northwest it extends 450 miles north of the northwestern limit of the latter species. If sometimes a hybrid it is not always so.

In many of its stations *Danthonia Alleni* occurs in recent clearings or burns where the loose litter and often the ashes from fires stimulate all plants; in such cases it appears like overstimulated specimens, in which rankness of growth, multiplication of spikelets and enlargement of their parts are the result. In other cases the autumnal coarse culms and panicles suggest the second flowering in many species of *Carex*, where autumnal inflorescences are larger, fuller and often more crowded than the normal vernal ones. Again, the panicles of *D. Alleni* may be greatly distorted and with apparent signs of fungus- or insect-attack, with gnarled or crumpled branches, tendencies to fasciation, and sometimes the gathering of spikelets into glomerules. All in all, *D. Alleni* is a heteromorphic series well worth close observation by those situated to watch it. That it is a true species is very improbable. It is presumably the result of very diverse conditions which have resulted in parallel developments; and, in view of the well known development within the leaf-sheaths of this genus of cleistogamous florets, it is not improbable that every alteration of *D. spicata* and *D. compressa*, whether by crossing through wind-pollination or stimulation in other ways, may be somewhat perpetuated through the cleistogenes. Similarly the very diverse lemmas of *D. spicata*, whether with awnless or awned teeth triangular or lanceolate, the backs pilose or glabrous, may thus be carried on in local colonies. The genus is an appropriate one for close study from many viewpoints.

I am distinguishing the two undoubted species and the wholly dubious *Danthonia Alleni* by the following characters.

a. Culms erect or straight, with stiffly erect panicles, the internodes terete (sometimes compressed or triangular in no. 2); basal crowded leaves much shorter than culm (sometimes elongate in no. 2), the lower cauline ones commonly 3–15 cm. long, the uppermost (except sometimes in no. 2) usually 1–10 cm. long and becoming remote from the panicle; ligule (except sometimes in no. 2) of stiff hairs 0.4–1.5 mm. long; panicle-branches ascending to erect, tightly appressed in fruit; spiraling base of awn usually

dark brown to purplish, strongly contrasting with the paler and straightish summit.

Culms slender, 0.5–1.5 mm. thick (dried) at base, 1–6 dm. high, with terete internodes; panicle remote from upper leaf, mostly with 2–13 spikelets; longer glume 7–11 mm. long, if longer with faint or obscure lateral nerves; base of awn dark-colored ..... 1. *D. spicata.*

Culms stout, 1.5–2.5 mm. thick at base, mostly 0.5–1 m. high, the lower internodes terete, or triangular and with one concave side; panicle either remote or closely subtended by upper leaf, dense, usually with 9–20 spikelets; longer glume lance-attenuate, 1.1–2.5 cm. long, prominently 3–7-ribbed; base of awn light to dark brown .... 2. *D. Alleni.*

a. Culms slightly geniculate at the nodes, the summit usually arching; some of the lower internodes trigonous or compressed and often with the narrower side broadly concave; basal leaves prolonged, one half as long as to equaling culm; lower cauline leaves prolonged, 1.5–4 dm. long, the uppermost nearly reaching or overtopping the panicle; ligule 2–4 mm. long, of flexuous hairs; panicle lax and open or with branches finally loosely ascending, the remote lower branches usually strongly divergent, not closely appressed in fruit; spiraling base of awn pale brown or stramineous ..... 3. *D. compressa.*

1. D. SPICATA (L.) Beauv. consists of three fairly defined and many less definite variations, as follows.

a. Column of florets three fourths to quite as long as the firm glumes; panicle with (1–) 2–13 (–15) spikelets; lower leaves flat or involute; culms firm, 0.5–1.5 mm. thick at base.

Glumes lance-attenuate, tapering from near base, with 3–5 strong ribs besides the midrib, covering only the base of the column of florets, the sinus at crossing of the glumes one sixth to one fourth as high as the tip of the longest glume; basal marcescent leaves strongly curving and twisting *D. spicata*, var. *typica.*

Glumes oblong-lanceolate, tapering from near or above the middle, with weak or obscure lateral ribs, usually covering all but the summit of the column of florets, the sinus at crossing of the glumes one fourth to half as high as the tip of the upper glume; basal leaves only slightly if at all curling ..... Var. *pinetorum.*

a. Column of florets only one half to three fifths as long as the thin and hyaline ribless or only faintly ribbed glumes; spikelets 3–7, scattered; culms delicate, 0.5–1 mm. thick at base; basal leaves filiform-involute or becoming so, curved ..... Var. *longipila.*

D. SPICATA (L.) Beauv., var. **typica.** *Avena spicata* L. Sp. Pl. i. 80 (1753). *A. glumosa* Michx. Fl. Bor.-Am. i. 72 (1803). *D. glumosa* (Michx.) Beauv. Ess. Agrost. 92, 153 and 160 (1812). *D. spicata* (L.) Beauv. ex Roem. & Schultes, Syst. ii. 690 (1817). *Merathrepta spicata* (L.) Raf. ex Hook. f. & Jacks. Ind. Kew. iii.

211 (1894) in synonymy. *D. spicata,* var. *villosa* Peck in N. Y. State Mus. Ann. Rep. xlvii. 168 (repr. 42) (1894), the form with villous blades. *Pentameris spicata* (L.) Nels. & Macbr. in Bot. Gaz. lvi. 470 (1913).—Dry to damp and peaty soils or in thin woodland, southern Quebec to Minnesota, south to Nova Scotia, New England, Long Island, northwestern Florida, Alabama, Tennessee and Missouri. May–early July.

Var. PINETORUM Piper, as *D. spicata pinetorum* Piper in Erythea, vii. 103 (1899), described in detail, although its author did not appreciate the characters, saying of it "scarcely more than a variety of that species [*D. spicata*], differing mainly in character of pubescence." *D. thermalis* (as *thermale*) Scribn., U. S. Dept. Agric., Div. Agrost. Circ. no. 30: 5 (1901). *Merathrepta pinetorum* (Piper) Piper, Contrib. U. S. Nat. Herb. xi. 122 (1906). *M. thermalis* (as *thermale*) (Scribn.) Heller, Muhlenbergia, v. 120 (1909). *M. thermalis* (as *thermale*), var. *pinetorum* (Piper) Piper ex Fedde & Schust. in Just, Bot. Jahresb. xxxvii. 128 (1911). *Pentameris thermalis* (as *thermale*) (Scribn.) Nels. & Macbr. l. c. (1913). *D. pinetorum* (Piper) Piper in Piper & Beattie, Fl. Nw. Coast, 46 (1915).—Dry to moist open soil, Newfoundland and Côte Nord, Quebec, to British Columbia, south to Nova Scotia, New Brunswick, northern New England, Bruce Peninsula, Ontario, northern Michigan, northern Wisconsin, Black Hills, South Dakota, New Mexico and Oregon.—Since this variety has not been heretofore recorded from east of northern Michigan a few characteristic eastern specimens of it may well be cited. NEWFOUNDLAND: Glenwood, *Fernald & Wiegand,* no. 4600; Grand Falls, *Fernald, Wiegand, Bartram & Darlington,* nos. 4601 and 4602; St. John's Island, *Fernald et al.* no. 27,466; Middle Arm, Bonne Bay, *Fernald, Long & Fogg,* no. 1300; North Arm, Bay of Island, *Long & Fogg,* no. 74; French (or Tweed) Island, Bay of Islands, *Fernald, Long & Fogg,* no. 76; Blomidon ("Blow-me-down") Mountains, *Fernald & Wiegand,* nos. 2591 and 2595; Mt. Musgrave to Humber Mouth, *Fernald & Wiegand,* no. 2590. QUEBEC: Mingan, *St. John,* no. 90,140; Anticosti Island, *Victorin,* or *Victorin et al.* nos. 4077, 20,536 and 20,537, 20,542, 20,598, 24,344–24,346, 27,795, 27,797, 27,798, 28,050, 28,055 and 28,060; Percé, *Fernald & Collins,* no. 870; River Ste. Anne des Monts, *Fernald & Collins,* no. 413; Bic, *Fernalds & Collins,* no. 869; Rivière du Loup, *Victorin,* nos. 22 and 81; Montmorency Falls, *Macoun,* no. 69,231; Saint-Romuald, *Louis-Marie,* no. 20,541. NEW BRUNSWICK: Bass River, July 30, 1875, *Fowler;* Shediac Cape, *F. T. Hubbard,* no. 720. NOVA SCOTIA: St. Paul Island, *Perry & Roscoe,* nos. 64–66; Middleton, *Fernald, Pease & Long,* no. 19,953; Argyle, *Long & Linder,* no. 19,957; Abram River, *Fernald, Bean & White,* no. 19,956. MAINE: at 4000–4500 ft., North Basin, Mt. Katahdin, July 14, 1900, *Fernald;* Township

ix, Range 17, Somerset County, *St. John*, no. 2134; Madison, August 21, 1894, *Fernald*. NEW HAMPSHIRE; near Half-way House, Thompson & Meserve Purchase, *Pease*, no. 12,817. VERMONT: Willoughly, July 11, 1896, July 18, 1898 and September 14, 1898, *G. G. Kennedy*.

Var. LONGIPILA Scribn. & Merr. U. S. Dept. Agric., Div. Agrost. Circ. no. 30: 7 (1901).—Sandy or rocky woods and clearings, North Carolina and Alabama to New Mexico, north to Connecticut, Pennsylvania, Kentucky, Missouri and eastern Kansas. Late May–September, The following are characteristic. CONNECTICUT: Woodbury, July 13, 1932, *Eames*. PENNSYLVANIA: Philadelphia, 1862, *C. E. Smith*. VIRGINIA: eastern slope of Bull Run Mountain, Prince William County, *Allard*, no. 3850; south of Aldie, Fauquier County, *Allard*, no. 859; 4 miles northwest of Dixie Caverns, Roanoke County, *Wood*, no. 2609; Great Neck, Princess Anne County, *Fernald, Griscom & Long*, no. 4553; Claremont Wharf, Surry Co., *Fernald & Long*, no. 9829; Carey Bridge, Southampton County, *Fernald & Long*, no. 11,950; Cypress Bridge, Southampton County, *Fernald & Long*, no. 11,949. NORTH CAROLINA: Locust, Stanly County, *Blomquist, Correll & Garren*, no. 7753; Highlands, Macon County, *Biltmore Herb.*, no. 343°. KENTUCKY: Hawesville, Hancock County, *E. J. Palmer*, no. 17,804. ALABAMA: Mobile, *C. Mohr*, as *D. sericea*. MISSOURI: Indian Creek, Benton County, *Demetrio*, no. 87; Mansfield, *Lansing*, no. 3103. KANSAS: Cherokee County, *Hitchcock*, no. 905. OKLAHOMA: base of Rich Mt., near Page, Leflore County, *Stevens*, no. 2674. TEXAS: Dallas, *Reverchon;* Terrell, Kaufman County, May 4, 1904, *F. J. Tyler*. NEW MEXICO: 1847, *Fendler*.

When they published var. *longipila*, from Arkansas, Scribner & Merrill laid stress on the "scattered ascending hairs", on the leaf-blades, a character which appears in the other varieties of the species and which may be absent from much material of otherwise good var. *longipila*. The distinctive features of this southern extreme are the very slender culms, usually filiform-involute leaves, and the small florets in relatively short columns, characters brought out in the original description: "A slender form . . . with small, few-flowered panicles and smaller spikelets than in the species. Leaf blades very narrow, involute . . . Flowering glumes 2 to 2.5 mm. long, pilose."

2. D. ALLENI Austin in Bull. Torr. Bot. Cl. iii. 21 (1872). *D. Faxoni* Austin, l. c. vi. 190 (1877).—Open shores, rocky or arid openings, clearings and burns, Magdalen Islands to Algoma District, Ontario, south to Nova Scotia, Maine, Massachusetts,

Delaware, mountains of North Carolina, and Ohio. Late June–October.—The following, selected from twice as many specimens, are characteristic. QUEBEC: Baie St. Paul, Charlevoix County, *Pease*, no. 27,471. MAGDALEN ISLANDS: Grindstone, *Fernald, Bartram, Long & St. John*, no. 6870. PRINCE EDWARD ISLAND: Alberton, *Fernald & St. John*, no. 6869. NOVA SCOTIA: Canso, Guysborough County, *Rousseau*, no. 35,452 bis; Bridgewater, Lunenburg County, *Fernald et al.*, no. 19,951. MAINE: Houlton, *Fernald & Long*, no. 12,659; Orono, September 25, 1890, and September 1, 1893, *Fernald;* Peaked Mt., Clifton, August 22, 1897, *Fernald;* Pleasant Pond, Somerset County, August 18, 1902, *Collins & Chamberlain;* Chesterville, *Kate Furbish;* Oxford, July 12, 1914, *Weatherby;* Pleasant Mt., Denmark, *Pease*, no. 19,628; Cutler, August 19, 1902, *Kate Furbish;* Pembroke, *Fernald*, no. 1309; Somesville, Mt. Desert I., September 22, 1892, *Fernald;* Southport, August 1, 1894, *Fernald;* Bear Mt., Livermore, July 25, 1896, *Kate Furbish;* South Berwick, *Parlin & Fernald*, no. 934. NEW HAMPSHIRE: Gorham, *Pease*, no. 17,337; Notch of the White Mts., August 27 and September 3, 1877, *C. E. Faxon*, TYPE collection of *D. Faxoni;* Crawford Notch, *Greenman*, nos. 1276 and 1277; Crawford Notch, Hart Location, *Pease*, no. 11,727; base of Mt. Willard, August 28, 1877, *Faxon;* North Woodstock, Woodstock, *Fernald*, no. 11,550; Plymouth, *Fernald*, no. 14,995; Washington, *Fernald & Svenson*, no. 768; Nashua, *Fernald & Svenson*, no. 769; Pelham, 1895, *F. W. Batchelder*. MASSACHUSETTS: Amesbury, 1897, *A. A. Eaton;* Pepperell, August 30, 1886, *C. W. Swan;* Concord, September 8, 1858, *Thoreau;* Ashland, July 3, 1884, *W. Deane;* Savin Hill, Dorchester, September 5, 1852, *Wm. Boott;* Plymouth, *Fernald*. no. 767; Brewster, *Fernald*, no. 17,948; Chatham, *Fernald & Long*, no. 8751; Nantucket Island, *Bicknell*, no. 9854; Shrewsbury, *J. W. Robbins*, as *D. sericea* Nutt.; Whitcombe Summit, Berkshire County, *H. D. House*, no. 25,893. NEW YORK: Babylon, Long Island, *T. F. Allen*, ISOTYPES of *D. Alleni*, also *Svenson*, no. 6800; Rockaway, Long Island, September 20, 1869, *W. H. Leggett:* NEW JERSEY: Nanasquan, June 26, 1929, *J. R. Churchill.* PENNSYLVANIA: Chester Valley, 2 miles north of Devon, Chester County, October 24, 1921, *H. B. Meredith.* DELAWARE: **"WM. M. CANBY,** WILMINGTON, DELAWARE". NORTH CAROLINA: Roan Mt., July, 1889, *Scribner.* ONTARIO: Cloche Peninsula, Manitoulin District, *Fernald & Pease*, no. 3103; cliffs by Lake Superior, Pancake Bay, Algoma District, *Pease & Ogden*, no. 24,989. OHIO: near Garrettsville, Portage County, June 19, 1910, *A. N. Rood.*

3. D. COMPRESSA Austin in Peck, N. Y. State Mus. Ann. Rep. xxii. 54 (1869). *D. spicata*, var. *compressa* (Austin) Wood, Am. Bot. and Fl. pt. 4: 396 (1873). *Merathrepta compressa* (Austin) Heller, Muhlenbergia, v. 120 (1909). *Pentameris compressa*

(Austin) Nels. & Macbr. in Bot. Gaz. lvi. 469 (1913).—Woodlands and clearings, southern Quebec to Ohio, south to Nova Scotia, New England, Long Island, Virginia, and upland of North Carolina and Tennessee. June–August.

III. ERIANTHUS BREVIBARBIS AND OTHER SPECIES

(Plates 758–761)

ERIANTHUS **coarctatus,** sp. nov. (TAB. 758), culmis rigidis 0.75–1.5 m. altis, ad basin 3–6 mm. diametro, nodis 4–6 barbatis barbis deciduis; foliis caulinis 4–6, vaginis glabris, laminis scabris e basi valde angustato sublanceolato-linearibus 2–10 mm. latis nerviis lateralibus prominulis utrinque 3–5; lamina superiore valde reducta 4–12 cm. longa; panicula lanceolata densa 1–1.7 dm. longa 3–4 cm. diametro basi deinde exserta, racemis valde adpressis 2–5 cm. longis; spiculis sessilibus lanceolatis, glumis strigoso-hirtellis 6.5–8 mm. longis, coma basilari 4–5 mm. longa; pedicellis strigoso-hirtellis; arista tereti porrecta 1.6–2 cm. longa. —Delaware, eastern Maryland and eastern Virginia. DELAWARE: fencerow, ¼ mile east of Ellendale, Sussex County, October 12, 1940, *R. R. Tatnall*, no. 4745. MARYLAND: roadside 5 miles north of Princess Anne, Somerset County, October 2, 1937, *R. R. Tatnall*, no. 3574. VIRGINIA: peaty swale (cut-over cypress swamp), about 4 miles northwest of Homeville, Sussex County, September 20, 1937, *Fernald & Long*, no. 7301, as *E. brevibarbis* Michx. (TYPE in Herb. Gray); alluvial woods along Nottoway River, Green Church Bridge, northwest of Owen's Store, Sussex County, October 14, 1941, *Fernald & Long*, no. 13,884. All but the last distributed as *E. brevibarbis*.

Var. **Elliottianus,** var. nov., planta major; culmis ad 2 m. altis ad basin 6–10 mm. diametro; laminis 7–12 mm. latis; panicula laxiore majoreque 2–4.5 dm. longa 4.5–10 cm. diametro, racemis 4–8 cm. longis.—North Carolina to Florida. TYPE: thicket bordering pond near Live Oak, Florida, October 10, 1901, *A. H. Curtiss*, no. 6940, as *E. alopecuroides*, var. *brevibarbis*.—The plant beautifully described as *E. brevibarbis* by Elliott, Sk. i. 39 (1816) and very crudely illustrated by him.

Erianthus coarctatus and var. *Elliottianus* have passed, ever since Elliott, as *E. brevibarbis* Michx. Nash in North Am. Fl. xvi[1]. 93 (1909) cites for *E. brevibarbis* the "TYPE LOCALITY: Tennessee" and then gives the range "Delaware to Florida, west of Louisiana"; while Hitchcock, Man. 723 (1935) says "Moist places, Coastal Plain, Delaware to Florida and Louisiana", but on p. 854 cites the type as from "Tennessee and Carolina, *Michaux*." Michaux, in originally describing it, Fl. Bor.-Am. i.

Photo. B. G. Schubert.

MUHLENBERGIA SETOSA (M. GLOMERATA): FIG. 1, type of POLYPOGON GLOMERATUS, × ⅓; FIG. 2, characteristic opaque and puberulent internode and node and base of sheath, × 5, from Pennsylvania.

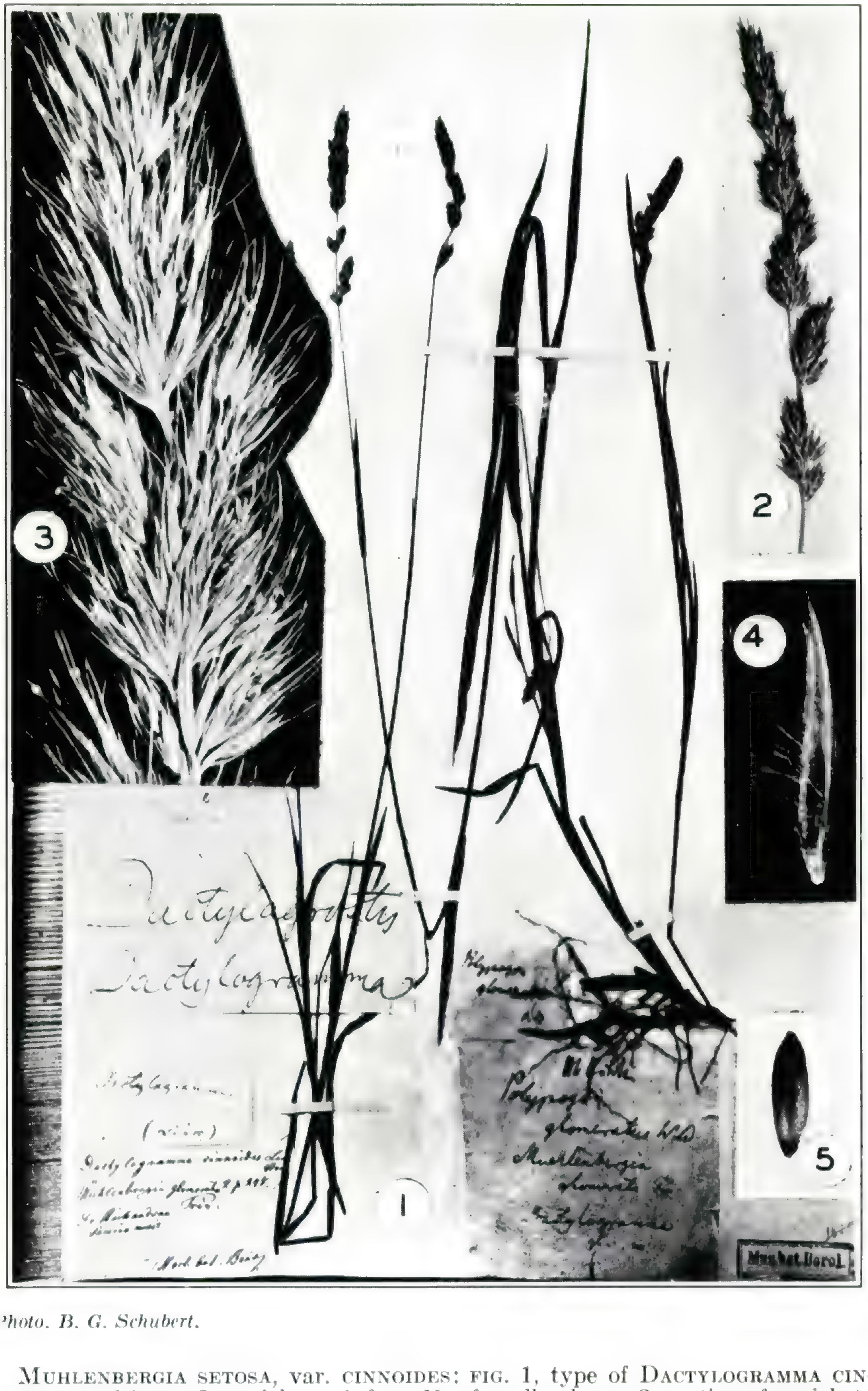


Photo. B. G. Schubert.

MUHLENBERGIA SETOSA, var. CINNOIDES: FIG. 1, type of DACTYLOGRAMMA CINNOIDES, × ⅓; FIG. 2, panicle, × 1, from Newfoundland; FIG. 3, portion of panicle to show elongate anthers, × 4, from Maine; FIG. 4, floret to show villi running high on lemma, × 10, from Newfoundland; FIG. 5, grain, × 10, from Quebec.

55 (1803), said "*HAB.* in collibus Tennassée et Carolinae". The discrepancy in Michaux's statement (and his label) and the Coastal Plain range of the plant usually taken to be *E. brevibarbis* has often been noted; and when Hitchcock examined the Michaux TYPE he wrote:

> **Erianthus brevibarbis** Michx.
>
> "In collibus desertis ab amnio Wabash ad Ostium Missouri 5 diebus distantibus". The specimen belongs to the species described in Small's Flora under this name. The range as originally published is "in collibus Tennassée et Carolinae". The known range is from Delaware southward along the coast to Florida, and west to Louisiana. We do not know of its occurrence in southern Illinois, as given on Michaux's label.—Hitchc. Contrib. U. S. Nat. Herb. xii³. 151 (1908).

Michaux's type, with the label as quoted by Hitchcock, is here reproduced × ½, as PLATE 759, FIG. 1. That it is very unlike the Coastal Plain plant for which it has passed is evident. Its apparently mature and disintegrated panicle is hidden amongst the broad and prolonged leaves and enlargements of the spikelets, FIG. 2, × 1½, show them to be like those of the plant (PLATE 760) of Pulaski County, Arkansas, distributed by Dr. Delzie Demaree (by creek near old quarry, Pulaski Heights, Little Rock, September 23, 1931, *Demaree*, no. 8228). Like that of the Michaux type the panicle (PLATE 760, FIG. 1, × ½) of Demaree's no. 8228 is disintegrating. In equivalent latitudes of the Coastal Plain *E. coarctatus* sheds its fruit from mid-October into November. Since the Demaree plant is so like Michaux's type from well up in the Mississippi Valley we may note that it has 10, instead of only 4–6 nodes; the leaf-blades broader (up to 1.5 cm. wide) and with more numerous veins (the more prominent veins 6–8 each side of the midrib); the mature panicle partly included at base and greatly exceeded by the broad upper blade (2.3 dm. long); the glumes (PLATE 759, FIG. 3, × 6) with glabrous and lustrous surfaces (Michaux said "valvis acutissimis, nudis"); the more abundant beard up to 6 mm. long; and the awn (PLATE 760, FIG. 3, × 3) only 8–10 mm. long, less than twice, instead of nearly thrice the length of the glumes.

The collection in Arkansas of a plant which closely matches the Michaux type and which is so different from the *Erianthus "brevibarbis"* of most authors supports Michaux in his statement on the label. Although the assertion (generally attributed to

Richard who issued the work after the death of Michaux) in the original publication, that it came from hills of Tennessee and from Carolina does not coincide with the original label, there is now clear evidence that a plant like Michaux's does occur in the Mississippi basin. It is not without significance that Hackel, the master of the *Gramineae*, doubted the identity of Michaux's plant with that of Elliott. In his great work on the *Andropogoneae* in DC. Mon. Phan. vi. 131 (1889), treating *E. brevibarbis*, as *E. saccharoides* subsp. *brevibarbis*, he accurately described the newly recognized *E. coarctatus*, var. *Elliottianus*, doubting if he had the Michaux species (transferred by Persoon to *Saccharum*), his citations reading: "Er. brevibarbis Mich. . . . ?, certe Elliott, Sketch . . . et aliorum auctt. amer.; Sacch. brevibarbis Pers. . . . ?" His doubt seems to have been justified; at least, *E. coarctatus* and *E. brevibarbis* seem quite as distinct as do most of our species in the genus. As to the range of the latter, it is yet to be worked out. The botanists of Indiana, Illinois, Tennessee and Missouri seem not to have noted it; and, although Demaree's label bears the memorandum, "New to Ark.", Hackel, l. c. cited as *E. brevibarbis* Arkansas material at Berlin, received from Engelmann. Michaux's label, giving the data, on dry hills 5 days distant from the River Wabash toward the mouth of the Missouri, means that he got it in southern Illinois, presumably between Jefferson County at the east and Randolph County at the west. On August 23, 1795, Michaux, with an Indian, and a horse to carry his baggage, left Vincennes on the Wabash, in Knox County, Indiana, and on the 28th spent the day drying out his water-soaked collections by a camp-fire, reaching Kaskaskia, in Randolph County, Illinois, on the 30th. From late August to October 2 he collected up and down the Mississippi, with Kaskaskia as a base, and then returned to the Ohio. Five days travel from Vincennes, allowing for the stops recorded in Michaux's diary, means that he got *Erianthus brevibarbis* in southwestern Illinois; and it is clear that his over-mature material was collected, at latest, in early October. The latter fact and the over-ripe material from Arkansas, collected on September 23, indicate that true *E. brevibarbis*, although little known, is a relatively early species to mature.

In habit and in dense panicle with appressed-ascending

branches, typical *Erianthus coarctatus* strongly suggests *E. strictus* Baldwin; but the panicle of *E. strictus* is more slender and elongate and its spikelets are naked at base or with the merest suggestion of a greatly abbreviated coma at the tips of some pedicels. Furthermore, in eastern Virginia *E. strictus* is the earliest-flowering species of the genus, our 8 collections, from young anthesis to mature fruit ranging in date from July 20 to September 19, with a single one, from wet woods, secured on October 18; the Virginia collections of *E. coarctatus*, both immature, were made on September 20 and on October 14.

Michaux, who established the genus *Erianthus*, did not realize the complexity of the genus. He recognized but two species: his *E. saccharoides*, "a Carolina ad Floridam", with "gluma villis involucrantibus multo breviore", identical with *Anthoxanthum giganteum* Walt. (1788); and *E. brevibarbis*. *E. strictus*, *E. coarctatus* and other species which he must have encountered and collected, were not worked out by him or, presumably, were confused with those of which types are preserved.

Related to *Erianthus brevibarbis* and *E. coarctatus* in having the terete awns projected forward (rather than flattened ones spirally twisted at base and with the straightish tip thrown somewhat to one side) are two plants with thicker panicles and with coma exceeding the glumes: *E. saccharoides* Michaux or *Anthoxanthum giganteum* Walt. = *E. giganteus* (Walt.) F. T. Hubbard and sensu Hitchcock, but certainly not *E. giganteus* Muhl., to whom Hitchcock erroneously ascribes the species; and *E. compactus* Nash. Before considering the differences between these two it is necessary to consider the correct name for the plant which Hitchcock, Man., is calling *E. giganteus*, for it is quite clear that his discussion (Man. p. 854) was based on confused ideas and inaccurate quotation of Muhlenberg's Catalogue. Hitchcock's paragraph is as follows:

(5) **Erianthus giganteus** (Walt.) Muhl., Cat. Pl. 4. 1813. Based on *Anthoxanthum giganteum* Walt. Later (Descr. Gram. 192. 1817) Muhlenberg uses the name for both *E. saccharoides* [Michx., 1803] and *E. alopecuroides* [L. (Ell.)] (his herbarium specimen under this name including both species), but the description (awn twisted) applies better to *E. alopecuroides*. *Erianthus giganteus* was published as new by Hubbard (Rhodora **14:** 166 (1912) based on *Anthoxanthum giganteum* Walt.

If, as Hitchcock definitely states, the name *Erianthus giganteus* Muhl. Cat. had been based on *Anthoxanthum giganteum* Walt., there was no need of a new combination by Hubbard; but Hubbard in 1912 was following the International Rules of that period and, as he clearly and correctly explained, *E. giganteus* Muhl. Cat. (1813) was NOT based on *Anthoxanthum giganteum* Walt., but was a change of name by Muhlenberg of *Andropogon alopecuroides* L. Since by present-day rules Muhlenberg had no right to give the new specific name, instead of using the one assigned by Linnaeus, Muhlenberg's quite new name, *Erianthus giganteus*, is illegitimate; but, by the "homonym rule", adopted in the International Rules since Hubbard wrote, there is no room for a second *E. giganteus*, based on Walter's name, especially since Walter's species is admittedly identical with *E. saccharoides* Michx. As to Hitchcock's flat statement that Muhl. Cat. (1813) based the name *E. giganteus* upon *Anthoxanthum giganteum* Walt., the following reproductions of Muhlenberg's text indicates that the statement could not have been verified. The first reproduction is from ed. 1 (1813), the second from ed. 2 (1818).

[1]	26. ANTHOXANTHUM, 2. giganteum Walter v. erianthus	SPRING GRASS, gigantic,	
	27. ERIANTHUS, 1. giganteus, 2l andropogon, alopec. L.	ERIANTHUS, gigantic,	semen 1. Car. Virg.
[2]	27 ANTHOXAN′-THUM	SPRING GRASS	semen 1.
	2 giganteum, Walter. v. erianthus	gigantic	
	28 ERIANTHUS 1 giganteus 2l *Andropogon alopec.* L.	ERIANTHUS gigantic	semen 1. Car. Virg.

It is perfectly clear that Muhlenberg was maintaining Walter's *Anthoxanthum giganteum* under *Anthoxanthum!*, though with the rather vague intimation ("v. [vel] erianthus") that it was perhaps an *Erianthus*. He made no combination based directly upon it; but his *Erianthus*, the next genus, consisted of two other species, 1. *giganteus*, a substitute-name for *Andropogon alopec*[*uroides*] L., and 2. *E. brevibarbis* Michx., already discussed. In his Cat.

Photo. B. G. Schubert.

ERIANTHUS COARCTATUS: FIG. 1, type, × ⅖; FIG. 2, panicle, × 1; FIG. 3, summit of rachis of raceme, × 3; FIG. 4, spikelet, × 3; FIG. 5, spikelet, × 6.

Photo. B. G. Schubert.

ERIANTHUS BREVIBARBIS: FIG. 1, type, × ½; FIG. 2, spikelets of type, × 1½; FIG. 3 spikelet, × 6, from Arkansas.

ed. 2: 4 (1818) Muhlenberg repeated (see quotation above) the treatment of ed. 1, merely making *Andropogon alopecuroides* more emphatically the nomenclatural basis of *E. giganteus* by using italics: "1 giganteus *Andropogon alopec.* L."

There is no question, apparently, about the identity of *Erianthus alopecuroides* (L.) Ell., which was based on *Andropogon alopecuroides* L. Sp. Pl. ii. 1045 (1753), the type being *Clayton*, no. 601 from Virginia. A. photograph of the type, × ½, is reproduced as PLATE 761, FIG. 1, with an enlargement (FIG. 2) of spikelets, × 3, showing the characteristic flattened and twisted awn and the copious long coma. *Erianthus giganteus* Muhl. Cat. (1813), based directly upon it, has nothing to do with *E. giganteus* (Walt.) F. T. Hubbard; and the latter, a valid combination when published, must give way to E. SACCHAROIDES Michx. As to the definition by Muhlenberg of a plant he subsequently called *Erianthus giganteus*, that simply confirms his identification of it with *Andropogon alopecuroides* L., for he emphasized the twisted awn. I cannot follow the reasoning by which *E. giganteus* was taken up by Hitchcock in his Manual as *E. giganteus* "(Walt.) Muhl." In 1908 he was apparently right when he wrote of *Anthoxanthum giganteum* Walt. "The specific name can not be taken up because there is an *Erianthus giganteus* Muhl., based upon *Andropogon alopecuroides* L."—Hitchc. in Contrib. U. S. Nat. Herb. xii³. 151 (1908).

Although Nash in N. Am. Fl. xvii¹. 94 (1909) reduced to *Erianthus saccharoides* Michx. his own *E. compactus* Nash in Bull. Torr. Bot. Cl. xxii. 419 (1895) and although Hitchcock, Man. also reduces it to the ill-fated *E. giganteus*, it seems to me a very well defined variety. Typical *E. saccharoides*, as shown by a photograph of the type before me, has the excessively hairy panicle 2–6 dm. long, the long beard of the spikelet 2 or 3 times as long as the blades of the glumes. It occurs from Florida to Texas, north to southeastern Virginia. Typical *E. compactus* has the panicle only 1–2 dm. long and the beard from slightly longer than to barely twice the length of the blades of the glumes. It occurs from the Carolinas and Alabama northward to southeastern New York, New Jersey, eastern Pennsylvania, the District of Columbia, northern Virginia and Kentucky, in the southern part of its range working back to the Appalachian

Mountains. Throughout the region where it is beyond the range of *E. saccharoides* it is readily recognizable and quite distinct, but a large proportion of specimens before me from South Carolina show a mixture of the two trends (panicles up to 3.5 dm. long but with short coma, the blades of the glumes thus very evident in the panicle as contrasted with the hidden blades in typical *E. saccharoides*) while some specimens from Georgia lie between *E. saccharoides* and *E. compactus;* so that I am forced to consider *E. compactus* an essentially northern and inland variety rather than a true species:

E. SACCHAROIDES Michx., var. **compactus** (Nash), comb. nov. *E. compactus* Nash in Bull. Torr. Bot. Cl. xxii. 419 (1895).

It is, unhappily, necessary to discuss the type of *Andropogon divaricatum* L. Sp. Pl. i. 1045 (1753). This species has been made by Hitchcock and by Nash identical with *A. alopecuroides* L. l. c. (1753) and in 1908 Hitchcock took it up, apparently because of priority on the page, to replace *E. alopecuroides* (L.) Ell. (1816), saying

> **Andropogon divaricatum** L. Sp. Pl. 1045. 1753.
>
> The type specimen is marked "2 divaricatum" and is from Gronovius. As pointed out elsewhere [b] [b Bot. Gaz. **35:** 215. 1903], this is the same as *A. alopecuroides* L., which is an Erianthus. It should be called **Erianthus divaricatus** (L.) instead of *Erianthus alopecuroides* (L.) Ell. Linnaeus also cites a synonym from Gronovius which is based on Clayton no. 600. This is *Sorghastrum linnaeanum* (Hack.) Nash.—Hitchc. in Contrib. U. S. Nat. Herb. xii[3]. 125 (1908).

My faith in the acumen of Linnaeus is such that I do not expect to find him describing identical species twice on the same page, although such accidents did happen. The diagnosis in 1753 of *Andropogon alopecuroides* was "4. ANDROPOGON panicula laxa, aristis tortuosis". That was all except literary citations, which, since Linnaeus had a specimen (our PLATE 761, FIGS. 1 and 2) matching the diagnosis, are wholly secondary. Similarly *A. nutans* L., type of *Sorghastrum nutans* (L.) Nash, had a "panicula nutante" and our familiar *Andropogon virginicum* was described "paniculae spicis conjugatis" &c. All these accounts (except of *Andropogon nutans* L.) are borne out by photographs of the types before me. *Andropogon divaricatum* did not have a panicle. Instead it was clearly defined: "2. ANDROPOGON spica oblonga, floribus lanatis remotis divaricatis: arista flexuosa

nuda"; and the specimen in Linnaeus's Herbarium (PLATE 761, FIGS. 3 and 4) when he prepared his diagnosis, therefore the TYPE, coincides most accurately with the brief but clear account. What it is I do not know. It was misidentified by Linnaeus with a plant of Clayton's from Virginia, "Lagurus humilior, panicula conica laxa nutante culmum terminante", a plant which Hitchcock says is the same as 3. *A. nutans* L. (*Sorghastrum nutans*). It would be most extraordinary if Linnaeus confused specimens of his nos. 2 and 3 and if Gronovius and Clayton before him treated as two different species from Virginia material of only one, *A. nutans*, while they did not recognize the conspicuously different *Sorghastrum Elliottii* (Mohr) Nash, which is frequent in eastern Virginia.

According to Hitchcock's statement in 1908, "Linnaeus also cites a synonym from Gronovius which is based on Clayton no. 600. This is *Sorghastrum linnaeanum* (Hack.) Nash"—Hitchc. in Contrib. U. S. Nat. Herb. xii³. 125 (1908); and he subsequently (Man. 951) states that *S. Linnaeanum* (Hack.) Nash, going back to *Sorghum nutans*, subsp. *Linnaeanum* Hackel in Martius, Fl. Bras. ii³. 276 (1883), was "misapplied" by Nash "to *S. Elliottii* (Mohr) Nash". Most unfortunately, here, as in so many cases already discussed, error seems to have crept in. Clayton's no. 600, basis of the Gronovian reference given by Linnaeus under *Andropogon divaricatum*, is beautifully preserved material, for a photograph of which (our PLATE 761, FIG. 5) I am indebted to Dr. Ramsbottom. It is, indeed, the best sort of *Sorghastrum Linnaeanum*, i. e. *S. Elliottii;* and my faith in the acuteness of Clayton, Gronovius and Linnaeus is justified. To be sure, Hitchcock reduced *S. Linnaeanum* to *S. nutans* (L.) Nash; but it seems improbable that he could have read Hackel's original diagnosis:

> Panicula laxa, 25 cm. lg., nutans, oblonga, ramulis longioribus apice bispiculatis. Spiculae intense rufae, 6 mm. lg.; gluma prima ad medium parce pilosa, secunda glabra. Arista 23–25 mm. lg., columna subulam aequans, medio interum geniculata.
>
> *Andropogon nutans L. Spec. ed. 1. II. 1045 (non Mant. II); Ell. Sketch. I. 141.*
>
> *Sorghum nutans Chapm. l. c.*
>
> *America borealis: Florida, Georgia — Texas.*

The clear description by Hackel is very close to Hitchcock's

account of *Sorghastrum Elliottii*, with "panicle loose, 15 to 30 cm. long, nodding at apex, the filiform branchlets and pedicels flexuous . . . ; spikelets 6 to 7 mm. long, chestnut-brown at maturity, . . . first glume hirsute or glabrescent on the back; awn 2.5–3.5 cm. long, twice-geniculate". This strongly contrasts with the account of the plant Hitchcock calls *S. nutans*, with "panicle . . . yellowish, rather dense, contracted . . . at maturity . . . ; awn 1–1.5 cm. long, once-geniculate".

Returning to the actual *Andropogon divaricatum* L., the simple fact remains that its TYPE does not have a panicle. The photograph of it, kindly sent me by Mr. S. Savage (our PLATE 761, FIGS. 3 and 4), shows the summit of a culm with an oblong spike, the spikelets lanate, remote and divergent, the flexuous awn naked (spica oblonga, floribus lanatis remotis divaricatis: arista flexuosa nuda—*Linnaeus*). That it is not *Erianthus alopecuroides* (our PLATE 761, FIGS. 1 and 2) or any member of that genus is obvious. I have tried in vain to place it with anything Virginian or eastern American. The truncated pedicels of some of the spikelets suggest *Andropogon*, as does the spiraling awn; but no *Andropogon* which I know. It is not impossible that its source was far from Virginia. The photograph, poor as it is and showing the spikelets heavily impregnated with glue, may lead to its proper identification. It should be noted that the long-exserted peduncle is quite naked, with a prolonged and divergent blade at base. All eastern American species of *Andropogon* which have to be considered have close sheaths with appressed-ascending tips extending nearly or quite to the inflorescence. It should further be noted that one spikelet (FIG. 4) bears 2 or 3 spiraling awns, suggestive of *Danthonia*, but not of that genus. It is hoped that those who know the grasses will clarify the identity.

As to the type of *Andropogon nutans* L. I have no satisfactory information. The panicle of the wide-ranging species with short awns and pale spikelets is not nodding (*nutans*); but there is no doubt that the plants of Elliott, basis of *S. Elliottii*, and of Chapman were the latter very definite species. Since the identities of types throughout the group have been so discouragingly misunderstood, it is not at all improbable that the type of *A.*

Photo. B. G. Schubert.

ERIANTHUS BREVIBARBIS: FIG. 1, plant, × ½, from Arkansas; FIG. 2, summit of rachis of raceme, × 3; FIG. 3, spikelet, × 3.

Photo. B. G. Schubert.

ERIANTHUS ALOPECUROIDES: FIG. 1, type of ANDROPOGON ALOPECUROIDES, × ½; FIG. tip of same, × 3.

ANDROPOGON DIVARICATUM: FIG. 3, type, × $^{3}/_{5}$; FIG. 4, portion of same, × 2; FIG. paratype, *Clayton*, no. 600, × ½.

nutans, when critically compared, may lead to some alterations of our ideas. At least, it is probable that somewhere amongst the many names placed by Hitchcock in the reputed synonymy of his *S. nutans* others may be found earlier than *Chrysopogon Elliottii* Mohr (1897).

From the situation in *Erianthus* and in *Muhlenbergia* (see pt. I) it is evident that the TYPES of our eastern North American grasses need much further and closer study.

PLATE 758. ERIANTHUS COARCTATUS Fern.: FIG. 1, TYPE, × ⅖; FIG. 2, panicle, × 1; FIG. 3, summit of rachis of raceme, × 3; FIG. 4, spikelet, × 3; FIG. 5, spikelet, × 6.

PLATE 759. E. BREVIBARBIS Michx., kindness of Professor *Humbert:* FIG. 1, TYPE, × ½; FIG. 2, spikelets of TYPE, × 1½; FIG. 3, spikelet, × 6, from *Demaree*, no. 8228.

PLATE 760. E. BREVIBARBIS Michx.: FIG. 1, plant, × ½, from Pulaski County, Arkansas, *Demaree*, no. 8228; FIG. 2, summit of rachis of raceme, × 3, from no. 8228; FIG. 3, spikelet, × 3, from no. 8228.

PLATE 761. FIG. 1, TYPE of ANDROPOGON ALOPECUROIDES L. and of ERIANTHUS ALOPECUROIDES (L.) Ell., × ½, kindness of Dr. *John Ramsbottom;* FIG. 2, spikelets of same, × 3, to show twisted awns. FIG. 3, TYPE of ANDROPOGON DIVARICATUM L. and of ERIANTHUS DIVARICATUS (L.) Hitchc., × ⅗, kindness of Mr. *S. Savage;* FIG. 4, summit of inflorescence, × 2. FIG. 5, *Clayton*, no. 600, paratype of A. DIVARICATUM, i. e. SORGHASTRUM ELLIOTTII (Mohr) Nash, × ½, kindness of Dr. *Ramsbottom*.

IV. WHY NOT ANDROPOGON GERARDI?

As early as 1700 the common plant of eastern North America, known either as *Andropogon provincialis* Lam. Encycl. i. 376 (1785) or as *A. furcatus* Muhl. ex Willd. Sp. Pl. iv. 919 (1806), was cultivated and perhaps escaped in Provence, in southern France. Tournefort, Inst. i. 521 (1700) had it as his *Gramen dactylon*, villosum, ramosum, altissimum, Gallo-Provinciale; but it was not until 1761 that the cultivated plant of Provence was beautifully described and illustrated by a figure as *Andropogon spica digitatis, flosculis alternatim geminis, hermaphrodito aristato, sessili; masculo mutico, pedunculato* by Gérard in his Flora Gallo-Provincialis, 106 (fig. 4) and 107 (1761), a plant which grew in southern Provence (*Oritur in gallopr. australi.* Perenne). Gérard's description was so detailed and so lucid that it is here given in full:

Des. *Radix numerosâ fibrarum multifariam implicatarum prole luxurians. Culmi tripedales & ultrà, glabri, striati. Folia radicalia multa, lata, glabra, cespites constituentia; caulina quinque vel sex, admodùm vaginantia, inferne ad margines pilis raris vestita. Membrana ex apice vaginarum*

brevis, lacinulata, sub villosa. Spicae ex apice culmi plures, digitatae, inaequales. Flosculi ex quolibet pedunculi dente gemini, basi villosi; hermaphroditus sessilis, triangularis, calyce unifloro, bivalvi, valvulis aequalibus, corollâ longioribus, exteriori muticâ longiore, interiori breviore, bifidâ, aristatâ, aristâ ex apice divaricationis prodeunte, recurvâ, flosculo longiore. Filamenta tria, breviora, antherae croceae, nutantes, styli duo, stigmata plumosa, purpurascentia; semen ovatum. Masculus pedicellatus, pedicello plumoso, anguloso; glumâ calycinâ exterior, interiori paulò longior, corollae glumae inaequales, muticae, calyce breviores. Filamenta ut in hermaphrodito, pistillum abortiens.
Obs. *Variat calycibus glabris, & villosis.*

In his Encyclopédie méthodique, i. 376 (August, 1785) Lamarck published it as *Andropogon provinciale* from the Royal Garden at Paris, merely copying the diagnoses of Gérard and of Tournefort, and adding, in French, a brief interpretation, ending: "On trouve cette plante dans la Provence, & on la cultive au Jardin du Roi." Seven years later the plant of Gérard received another binomial, *A. Gerardi* Vitman, Summa Pl. vi. 16 (1792), Vitman copying Gérard's diagnosis and citing both that and the illustration, the plant occurring "*In Gallo provincia*". Then in 1806 the wide-ranging North American plant appeared as *A. furcatus* Muhl. ex Willd. Sp. Pl. iv. 919 (1806). That *A. provincialis* Lam. is the same species as *A. furcatus* Muhl. there seems no doubt. Franchet in Bull. Soc. Bot. France, xxxi. 350–352 (1884) gave a very detailed history of the plant in France and he concluded the study: "La plante figurée et décrite par Gérard et cultivée au Jardin du Roi dès 1763, plante qui est certainement le type de l'*A. provincialis* Lamk, comme en font foi les exemplaires desséchés à cette époque et qui se trouvent dans l'herbier du Museum, est une espèce américaine, nommée quarante-deux ans plus tard *A. furcatus* Muehl. in Willd. *Sp.* IV, 919 (1805 [1806]). L'*A. provincialis* doît donc être rayé de la flore française." That it has, consequently, been "struck out from the French flora" is indicated by Rouy, Fl. Fr. xiv. 21 (1913), where he states in a note that "l'**A. Provincialis** Lamk . . . = *A. furcatus* Mühlenb. . . . qui n'a existé en France que naturalisée et cultivée." Hackel, in his great and comprehensive monograph of the *Andropogoneae* in DC. Mon. Phan. vi. 441 (1889), had no doubt about the matter, definitely citing in the synonymy of *A. provincialis* both *A. Gerardi* and *A. furcatus*.

As it proves, unfortunately, the name *Andropogon provincialis* Lam. (1785), the name used by Hackel, by Nash in N. Am. Fl. and by many others, is clearly antedated by another *A. provincialis* Retz. Obs. Bot. iii. 43 (1783), a low annual, with 15 or 16 fascicled spikes, unequal subulate glumes, etc., obviously not Lamarck's species.[1] There is, however, little support for Hitchcock's doubt as to the identity of *A. provincialis* nor for his perplexity in settling which was earlier, Retz., l. c. or Lam. l. c. Hitchcock's statement is as follows:

> The name *Andropogon provincialis* Lam. (Encycl. i. 376. 1783), was applied to this species by Hackel (in DC., Monogr. Phan. 6: 441. 1889) and others, but Lamarck's species is uncertain. He states that he saw a plant in the Paris Botanical Garden, but his description is taken from Gerard (Fl. Gall. Prov. 107. pl. 4. 1761) and does not well apply to our species. Furthermore, *A. provincialis* Retz. (Obs. Bot. 3: 43. [31]. 1783), which appears to be a species of *Chloris*, was published the same year. The author is unable to determine which is the earlier. The part of Lamarck's Encyclodedie containing page 376 appeared in August 1783.—Hitchc. Man. 790 (1935).[2]

Hitchcock does not state *why* Gérard's "description . . . does not well apply to our species." Franchet and Hackel, both accurate students of grasses, felt positive of the identity; and perusal of Gérard's description side by side with Hitchcock's (Man.) shows nothing specifically distinctive. Any one can readily make the comparison. He is likely to arrive at the conclusion of Franchet, Hackel, Ascherson & Graebner, Rouy and others. As to Hitchcock's inability "to determine which is the earlier [Retz. Obs. Bot. iii. or Lam. Encycl. i. 376]", he was apparently relying on his own conclusion that "The part of Lamarck's Encyclopedie containing page 376 appeared in August 1783". It is too bad that the latter error in date confused the question for, as indicated by Sherborn and Woodward in Journ. Bot. xliv. 319 (1906), the part including p. 376 was published in August, 1785 (not 1783).

[1] Hackel (1889) placed it in *Chloris*.

[2] Hitchcock's inference that the plant, formerly cultivated in France, is "not . . . our species" may have arisen form Hackel's treating it as subvar. *genuinus*, with "spiculae . . . pedicellatae basi fasciculo pilorum manifesto 1,5 mm. longo barbatae" while his subvar. *furcatus* was "ut precedens, sed spiculae pedicellatae basi glabrae v. obsolete barbulatae." It is a very exceptional plant of eastern North America which lacks the bearding at the base of the pedicelled spikelet or at the summit of the pedicel. The distinctive point stated by Hackel is of no importance.

Since *Andropogon Gerardi* Vitman (1792) is the same as *A. provincialis* Lam. (1785) and *A. furcatus* Muhl. (1806), that appears to be the proper name for our common species. The following are the most marked varieties:

A. GERARDI Vitman, var. **paucipilus** (Nash), comb. nov. *A. paucipilus* Nash in Britt. Man. 70 (1901). *A. provincialis* Lam., var. *paucipilus* (Nash) Fern. & Grisc. in RHODORA, xxxvii. 147 (1935).

A. GERARDI, var. **chrysocomus** (Nash), comb. nov. *A. chrysocomus* Nash, l. c. (1901). *A. provincialis*, var. *chrysocomus* (Nash) Fern. & Grisc. l. c. (1935).

(To be continued)

A NEW STREPTANTHUS FROM THE BIG BEND OF TEXAS

V. L. CORY[1]

THIS unique Streptanthus was first collected on February 28, 1937, by Mr. Hugh Cutler, and the collection bears his number 677. This collection is designated the type specimen, and it is deposited at the Gray Herbarium. From a study of this specimen the writer drafted a tentative description and gave it a tentative unpublished name. Although the botanists who have seen this material agree that it is a species of Streptanthus, it seemed better not to publish the description until the plant could be taken in fruit. The writer was unable to visit the locality of growth of this plant at the time for taking it in fruit, but Dr. Hugh Cutler has been more fortunate in this respect, for on May 3, 1941, he visited the exact locality (the point where the old wagon road enters Maravillas Canyon at four miles from Black Gap) and found the plant growing in abundance and in fruit. In addition to sending me this desired material Dr. Cutler also sent some to the Gray Herbarium. The material he sent me was not numbered, so it has been assigned my number, 37078. The circumstances clearly justify naming this species in honor of its discoverer, and I take pleasure in withdrawing the name originally proposed and in making the proper substitution.

[1] Acting Chief, Division of Botany, Texas Agr. Expt. Station, A. and M. College of Texas.

STREPTANTHUS **Cutleri,** n. sp. Plant annual, 35–50 cm. high, glabrous throughout; stems terete, simple at base, usually branched above, 2 mm. in diameter or less; basal leaves 5–10, oblanceolate, petioled, runcinate-pinnatifid, 5–10 cm. long, up to 2 cm. broad, becoming purplish, terminal lobe broad with about 3 sinuses extending halfway to the midrib, the apex broadly triangular; cauline leaves ascending, as long as or longer than the basal leaves, with narrower segments, the terminal segment lanceolate to linear-lanceolate, usually entire except towards base; the upper cauline leaves linear, entire, or undulate to few-toothed basally; petioles scarcely differentiated from the blades, purplish, narrowly winged, dilated at base, 3-nerved, not clasping; petals 4, clawed, 2 developing ampliate blades, 2 represented by the claws only, the developed petals about 25 mm. long, the claws ¾ and the blades ⅖ of the total length; claws of petals 10 mm. long, up to 2 mm. broad, greenish below, pale above, in the undeveloped petals crisped or toothed above; blades of petals 10–14 mm. long, 5–6 mm. broad, ovate, erose or crisped, pale purplish, prominently pinnately nerved with darker purple branching veins; calyx campanulate, somewhat saccate, not carinate; sepals 5, oblong, purple, 10–12 mm. long, thin and scarious to greenish for as much as 2 mm. at the obtuse tips; anthers linear, sagittate; pods very flat, 3.5–6 cm. long, 4 mm. broad, glabrous, ascending, the peduncles 10–18 mm. long, each cell usually 8-seeded or more; seeds orbicular, light brown, broadly winged, the body and wing 4 mm. broad, the body 2 mm. broad.

STREPTANTHUS **Cutleri,** sp. nov. Planta annua, 35–50 cm. alta, tota glabra; caulibus teretibus, basi simplicibus, supra plerumque ramosis, 2 mm. crassis vel minoribus; foliis basalibus 5–10, oblanceolatis, petiolatis, pinnatifido-runcinatis, 5–10 cm. longis, ad 2 cm. latis, purpurascentibus, lobo terminali lato sinubus ad mediam costam, apice late triangulari; foliis caulinis adscendentibus foliorum basalium longitudinem aequantibus vel excedentibus, lobis angustis, terminali lanceolato vel linearilanceolato, saepius basi excepta integro; foliis caulinis superioribus linearibus, integris vel repandis vel parcius deorsum dentatis; petiolis vix a lamina distinctis, purpureis, anguste alatis, basi dilatatis, 3-nerviis haud amplectentibus; petalis 4, clavatis quorum 2 in laminas amplas abeuntibus, 2 unguicularibus tantum, petalis evolutis ca. 25 mm. longis, unguibus ¾ laminae ⅖ longitudinis totius; unguibus 10 mm. longis, ad 2 mm. latis, subtus viridescentibus, supra pallidis, petalorum haud evolutorum apice crispis vel dentatis; laminis 10–14 mm. longis, 5–6 mm. latis, ovatis, crispis vel erosis, pallide purpureis, evidenter pinnatinervis, venulis ramosis obscure purpureis; calyce campanulato subsaccato haud carinato; sepalis 5, oblongis, purpureis, 10–12 mm. longis, apice ca. 2 mm. tenuibus scariosis vel virides-

centibus; antheris linearibus, sagittatis; leguminibus valde compressis, 3.5–6 cm. longis, 4 mm. latis, glabris, adscendentibus, pedunculis 10–18 mm. longis, cella quave saepius seminibus 8 vel ultra donata; seminibus orbicularibus, pallide brunneis, late alatis, totis 4 mm., parte centrali 2 mm. latis.[1]

The type locality of this species is in Maravillas Canyon of Brewster County, Texas, about fifty miles south of Marathon and four miles northeast of Black Gap, at an elevation of 2500 feet. This species is distinct in that only 2 petals develop ampliate blades. It differs from other species of West Texas in that its leaves are not clasping. Of these species its closest relationship seem to be with *S. platycarpus* A. Gray.

THE VARIATIONS OF BRACHYELYTRUM ERECTUM

WILLIAM K. BABEL

IN eastern North America, *Brachyelytrum erectum* (Schreb.) Beauv. exhibits two well-defined geographic tendencies; the northern plants are characterized by having glabrous or scabrous lemmas, while the southern plants have strongly hispid lemmas. These variations may be distinguished as follows:

Lemmas strongly hispid, the hairs 0.2 to 0.6 mm. long. . *B. erectum* (typical).
Lemmas glabrous or scabrous, with hairs 0.02 to 0.15 mm. long or less. . . . . *B. erectum* var. *septentrionale*.

BRACHYELYTRUM ERECTUM (Schreb.) Beauv., Ess. Agrost. 155 (1812). *Muhlenbergia erecta* Schreb. in Spreng., Mém. Acad. St. Pétersb. **2:** 287 (1807–08). ? *Dilepyrum aristosum* Michx., Fl. Bor.-Amer. **1:** 40 (1803). *Brachyelytrum aristatum* (Pers.) Roem & Schult. var. *Engelmanni* A. Gray, Gray's Man. ed. 5. 614 (1867). *Brachyelytrum aristosum* (Michx.) Trel. var. *glabratum* Vasey in Millsp., West Va. Agri. Expt. Sta. Bull. **24:** 469 (1892). *Dilepyrum erectum* (Schreb.) Farwell, Amer. Midl. Nat. **8:** 33 (1922).—Massachusetts south to Georgia, west to Louisiana and southern Wisconsin. Hitchcock states that the type of *Muhlenbergia erecta* Schreb. was collected in Georgia and Carolina.[2] The southern plants may therefore be considered the typical variety.

B. ERECTUM (Schreb.) Beauv., var. **septentrionale** var. nov., lemmatibus glabris vel scaberulis. Growing in rich soil in open

[1] I am indebted to Dr. Leon Croizat for aid in the preparation of the Latin description.

[2] Hitchcock A. S. Man. Grass. U. S., 810 (1935).

woods near Horticultural Farm, Durham, Strafford County, New Hampshire, June 19, 1942, *Babel* no. 46 (TYPE in the University of Wisconsin Herbarium).—Newfoundland to Connecticut and New Jersey, and west to northern Wisconsin, following the mountains south to West Virginia.

The type of *Brachyelytrum aristosum* var. *glabratum* Vasey has hispid lemmas and so belongs to the typical variety. It was separated from the species by Vasey on the basis of its glabrous blades and sheaths, but the glabrous blades and sheaths are found in the northern variety as well as the southern. Such specimens have been seen from North Carolina (typical), West Virginia (typical), and northern Maine (var. *septentrionale*). Since the glabrous plants are found in both varieties, it seems better not to consider them as another distinct variety.

Under *Brachyelytrum aristatum* (Pers.) Roem. & Schult., Gray named a var. *Engelmanni*. This was originally described as "a Western form, with upper glume awn-pointed, nearly half the length of the palet."[1] Through the kindness of Professor Fernald, I have been able to examine a specimen from St. Louis, Missouri, labeled var. *Engelmanni* in Gray's own handwriting, and which may, therefore, be considered as representing Gray's conception of this variety. The spikelets have long-awned second glumes, half the length of the palea, thus fitting Gray's description. Upon examining a large series of specimens, however, it becomes apparent that this variation is not confined to the western part of the range, but rather is found occurring sporadically throughout the range of the species. Individuals of both varieties here recognized show this character. A large number of plants exhibit both long-awned and awnless second glumes on different spikelets of the same plant. It does not seem advisable to maintain var. *Engelmanni* as originally defined by Gray, even as a form.[2] The specimen has strongly hispid lemmas and, therefore, belongs with the typical variety.

I am deeply indebted to Dr. Earl Core of the University of West Virginia for his kind loan of specimens; to Mrs. Agnes

[1] Gray Man. ed. 5. 614 (1867).

[2] It is possible to interpret the present International Rules as requiring that the name var. *Engelmanni* be retained for the typical variety since Gray's plant is typical *B. erectum* as here defined. This does not seem to be a wise course to follow, for in so doing, I must designate Gray's sheet as "type" of var. *Engelmanni*. There would then be two types, one for var. *Engelmanni* and the other for *Muhlenbergia erecta* Schreb.

Chase of the Smithsonian Institution for information concerning the location of the type of var. *glabratum;* to Professor M. L. Fernald of the Gray Herbarium for his kind loan of specimens; to Mr. F. W. Hunnewell of the New England Botanical Club for his loan of herbarium material; to Mr. Orr Goodson of the Field Museum for his kindness in loaning me herbarium material including the type of var. *glabratum.*

DEPARTMENT OF BOTANY,
University of Wisconsin

THE IDENTITY OF ASTER SALSUGINOSUS RICHARDSON

ARTHUR CRONQUIST

ON page 748, Appendix 7 (first edition), of Franklin's "Narrative of a Journey to the Shores of the Polar Sea", Richardson described *Aster salsuginosus* as follows:

323. A. salsuginosus: caule unifloro, foliis lineari-obovatis acutis sub-integerrimis venosis, calycibus laxe imbricatis linearibus acutis disco vix duplo radio plus triplo brevioribus. (W)[1]

Herbaceus. *Caules* plures ex eadem radice, dodrantales erecti aut ascendentes firmi simplices purpurei sed pilis brevissimis sub-incanis. *Folia* sessilia lineari-obovata lanceolatave plerumque acuta, integerrima vel ad apicem dentibus raris munita, venosa, utrinque concolora, supra glabra, subtus pilis brevibus patentissimis vestita. *Flos* magnus terminalis infra quem caulis paulo incrassatus est et villosus. *Calyx* laxiusculus pilis brevibus canis obtectus, laciniis linearibus acutis, marginibus purpurascentibus. *Flosculi disci* calyce fere duplo longiores: *radii* triginti sesqui-unguiculares disco duplo longiores, lineares sub-emarginati. *Germina* hirta pappo simplici dentato fuscuscente discum aequante coronata.

Hab. On the Salt Plains in the Athabasca.

A few years after Richardson's publication, Drummond returned from a trip to the Rocky Mountains, bringing specimens which Hooker identified as *A. salsuginosus.* Seeds which Drummond brought back were planted in gardens, and the garden plants were used for an excellent illustration in Curtis' Botanical Magazine (**16:** pl. 2942. 1829). Since that time, nearly all botanists, including Asa Gray as indicated by his treatments in

[1] As stated on page 730, W "denotes the wooded country from latitude 54 degrees to 64 degrees north."

the Synoptical Flora and elsewhere, seem to have accepted the Drummond specimens as typifying *Aster salsuginosus.*

In 1912 Dr. E. L. Greene[2] pointed out that *A. salsuginosus* Richardson (which by that time had been transferred to *Erigeron*) was not the same as the Rocky Mountain plant which commonly passed as *Erigeron salsuginosus* (Rich.) Gray. Without indicating the exact differences between it and *A. salsuginosus,* Greene proposed the name *E. callianthemus* for the Rocky Mountain plant. His proposal was not widely adopted.

In my work on the North American species of *Erigeron,* I was faced with the problem of the type of *A. salsuginosus.* It at once appeared that Richardson's description could not apply to the Rocky Mountain plant, which latter has distinctly glandular instead of white-hairy involucres, and has the leaves ordinarily essentially glabrous, certainly not "*supra glabra, subtus pilis brevibus patentissimis vestita.*"

A specimen of Richardson's original collection has been located at the Gray Herbarium, and through the kindness of Dr. M. L. Fernald has been made available to me for study. The label reads, in a bold hand which Dr. E. C. Abbe informs me is Richardson's, "323 Aster salsuginosus". Also on the label, in a hand which has not been identified, is the notation, "Richardson's Arctic Plants". The sheet bears two printed labels, which read, "Herb. John A. Lowell", and "Transferred from the Boston Society of Natural History to the Gray Herbarium of Harvard University, October 2, 1941". The number 323 on the label coincides with the number of the species in the first edition of Richardson's Appendix, and the plant matches the original description. There seems to be no room for doubt that it is one of the original Richardson specimens.

The plant is a form of the species which is now commonly called *A. Richardsonii* Spreng. It is larger than usual *A. Richardsonii,* approaching *A. Richardsonii* var. *meritus* (A. Nels.) Raup, but is clearly and unmistakably within the limits of variation of the species.

A. Richardsonii Spreng. was based on *A. montanus* Rich., which was the next species after *A. salsuginosus* in Richardson's appendix. (*A. montanus* Rich. was antedated by *A. montanus*

[2] E. L. Greene, *Some Erigeron Segregates,* Leafl. 2: 193–218 (1912).

Nutt., and thus untenable.) *A. salsuginosus* thus has obvious priority over *A. Richardsonii*.

I refrain from transferring *A. Richardsonii* var. *meritus* because I am not certain that *A. salsuginosus* is specifically distinct from *A. sibiricus* L. The two are evidently closely related, and an adequate decision can be reached only after study of a considerable series of specimens of each, in which I do not wish to involve myself at present.

The Rocky Mountain plant that has been confused with *A. salsuginosus* appears to be a subspecies of *Erigeron peregrinus* (Pursh) Greene. It may now be known as

E. PEREGRINUS (Pursh) Greene subsp. **callianthemus** (Greene), stat. nov. *E. callianthemus* Greene, Leafl. **2:** 197, 1912.

This subspecies and its varieties will be more fully treated in my revision of the North American Erigerons.

UNIVERSITY OF MINNESOTA

Volume 45, no. 533, including pages 169–216, was issued 1 May, 1943

JUL 12 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. July, 1943. No. 535.

CONTENTS:

Notes from the Bebb Herbarium of the University of Oklahoma—II. *Milton Hopkins.* 265

A Flora of Kentucky (Review). *M. L. F.* 277

A Check-list of Kentucky Plants (Review). *C. A. W.* 278

Contributions from the Gray Herbarium of Harvard University—No. CXLVIII. *M. L. Fernald.*

V. Studies in North American Species of Scirpus. 279

VI. The Identity of Scleria setacea of Poiret. 296

VII. What is Angelica triquinata? 298

Our Varieties of Barbarea vulgaris. *M. L. Fernald.* 304

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

Harv. Tax. Mag.

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. **July, 1943.** **No. 535.**

NOTES FROM THE BEBB HERBARIUM OF THE UNIVERSITY OF OKLAHOMA—II[1]

MILTON HOPKINS

THE ROBERT BEBB HERBARIUM.—Robert Bebb, senior member of the Bebb Floral Company of Muskogee, Oklahoma, died on February 21, 1942, after a prolonged illness. By the terms of his will the University of Oklahoma received his herbarium, comprising about 30,000 specimens, largely from Oklahoma but also from Illinois, Indiana, Texas, Minnesota, California and the Rocky Mountain region.

At its meeting on the 5th of May, 1942, the Board of Regents of the University unanimously voted to name the herbarium in honor of this distinguished amateur botanist and it has therefore become officially, the Bebb Herbarium of the University of Oklahoma. In the succeeding pages, references to this name indicate not merely the personal herbarium of Mr. Bebb, but rather the entire collections of the University, which now bear that name.

Robert Bebb was the youngest child of Michael S. and Katherine Hancock Bebb. He alone, of their children, was interested in pursuing the avocation which his father had so successfully followed. As a child he often accompanied his father on those numerous field trips which meant so much to them both. In his early manhood he was able to make trips on his own because

[1] I am deeply indebted to the Committee on Research Grants of the Society of the Sigma Xi for awarding me a grant-in-aid from its Alumni Fund. This made possible my work for this paper (and others), which was done at the Gray Herbarium of Harvard University. I wish also to thank Professor M. L. Fernald, Director of the Gray Herbarium, and the other members of the staff, who placed the entire facilities of the institution at my disposal, and gave me every possible courtesy and consideration.

his work as a Grain Receiving Agent for the Rock Island Railroad made it possible for him to have the afternoons free for collecting. At this time he also became intensely interested in landscape architecture and horticulture.

When he moved to Muskogee in 1910 and purchased the floral business which bears his name, he was so busy with the work of building the firm to the high standards of quality which it now enjoys, that he found only brief time for the pursuit of his hobby. During the vacations, which he never permitted to extend more than the usual two weeks, he botanized wherever the family went for the summer, sometimes in Colorado, sometimes in California and often in Minnesota. If there were free evenings he identified his specimens as best he could. If not, they were taken back to Muskogee and such time as was available was devoted to them. Because of pressure of the business, many of these early collections remained unidentified for years.

When he retired from business in 1936 he was able to devote practically all of his time to botany. This hobby occupied the daylight hours of spring, summer and fall, when he enjoyed long field trips. The winter days were spent in his library working on his identifications. He restricted his botanical activities to eastern Oklahoma, all areas of which were within easy driving distance from Muskogee. The country in which he worked has only been superficially botanized, except for the work of E. L. Little, Jr.,[1] whose publications on Muskogee County were familiar to Bebb. Latterly, the Bebb family purchased a summer cottage in Hubbard County, Minnesota, and there Mr. Bebb collected almost daily during July and August.

He was always insistent on having authentic determinations made for all his specimens, and when he could not satisfactorily identify a plant or when I was not able to help him on some of the more critical genera he would ask me to whom he might send his material for further checking and study. He enjoyed his correspondence with these various authorities and also with the curators of the large herbaria. When in the fall of 1941 he realized that he would probably not live through the winter, he set to work assiduously on his plants and made it a point to

[1] The Vegetation of Muskogee County, Oklahoma, in Am. Mid. Nat. **19**: 559–572. 1938. Flora of Muskogee County, Oklahoma, in Am. Mid. Nat. **19**: 369–389. 1938.

clear up the various problems which had been bothering him. He repeatedly informed me that he did not want to leave his herbarium in such a condition that it would require precious hours of my time rechecking and further identifying his material. At the time of his death nearly all of his recent collections were ready for insertion and the duplicates were arranged in precise and orderly fashion, requiring only the labels before being sent out in exchange. These duplicates are now in my storeroom and will be duly distributed whenever clerical help is available. Several thousand of these await the attention of a typist.

Mr. Bebb had the zeal and enthusiasm of a great botanist. Had he been able to pursue his hobby continuously during his earlier life his fame would undoubtedly have eclipsed that of his father. In the field he was constantly in search of rare and unusual plants and was always conscious of the most minute variations. If a plant looked slightly unfamiliar or if it did not quite ring true in his mind, he always collected large numbers of duplicates so that other botanists might share his discovery.

With characteristic modesty he underestimated his ability, and in the last few months of his life he repeatedly said that he hoped his efforts had been of some consequence but he felt that they were merely routine. I am quite certain that he was completely unaware of the new records for the Oklahoma flora which he had obtained, except as his various professional acquaintances informed him of them during his lifetime. Many of them were found only gradually as his personal herbarium was being inserted into that of the University. Some of these are included in the present paper, but as the work of insertion is still far from complete, many records are necessarily omitted.

With his herbarium, his widow, sons and daughter (Florence P. Bebb, Maurice R., Forrest and Mabel B. Potter) graciously insisted that the handmade solid walnut cases belonging to M. S. Bebb be included. These were made from an old tree which stood for many years on the farm at Rockford, Illinois.

EPIPACTIS GIGANTEA Dougl. MURRAY COUNTY: seepy, springy slopes of limestone in Dripping Springs, Cowpen Canyon in the Frank's Conglomerate formation, Arbuckle Mts., *Hopkins*, no. 5995.

This exquisite orchid, standing about two feet high, grows

abundantly in banks of Venus-hair fern which forms great mats around it. Water from clear limestone springs above the banks trickles down gently over its roots. This seems to be the only locality where the plant has been found in Oklahoma. The station nearest the Arbuckles one is in the vicinity of Dallas, Texas (100 miles to the south), but the orchid occurs in several southwestern counties of that state. Westward, south and north it has been collected in Mexico, and through New Mexico and Arizona to California, then locally throughout the Rockies to British Columbia. Of distinct Cordilleran affinities, its occurrence in Dallas and in the Arbuckles is of special interest.

LOEFLINGIA TEXANA Hooker. HARPER COUNTY: sand dunes on north side of Cimarron River, *Frank McMurry* (*ex. herb. Wichita Mt. Wildlife Survey, Cache, Oklahoma*).

This caryophyllaceous plant is listed from both the Edwards Plateau and the Plains Country regions in Texas by Cory.[1] Its inclusion in the Oklahoma flora is not surprising, as Harper County is usually included in the Plains region. That it has never before been collected within the state is probably due to the fact that the northwest counties have never been botanized extensively, and the collections of the late G. W. Stevens of Alva, while numerous, were for the most part extremely local and rather spasmodic. The large number of specimens which he took to the Gray Herbarium for his doctorial thesis (approximately 6,000) were obtained chiefly on field trips during the summers of 1912, 1913 and 1914. His itinerary was supposed to cover nearly all of Oklahoma. Obviously, his material from any one region could hardly be expected to be a complete representation of the plants occurring there.

This specimen closely resembles an *Arenaria*, and might easily be confused with that genus. Robinson gives its distribution from "Central and Eastern Texas . . . northward to Nebraska"[2], but there are no specimens in the Gray Herbarium from Oklahoma or the Indian Territory.

ARABIDOPSIS THALIANA (L.) Heynh. MCCURTAIN COUNTY: deep, rich, wet woods of sweet gum and red maple near Mt. Fork River, 5 miles north of Broken Bow, *Hopkins*, no. 6260.

No mention of the occurrence of this cruciferous plant in

[1] Catalogue of the Flora of Texas, Tex. Agri. Exp. Sta. Bull. no. 550: 44. 1937.
[2] In Gray, Synop. Flora i, pt. i, fasc. ii: 255. 1897.

Oklahoma has been made in the literature, and search through the large herbaria has failed to discover any specimens. It represents a new record for our flora and extends the range southwest. Broken Bow is immediately south of the Ouachita Mountains, in extreme southeastern Oklahoma.

ARABIS VIRIDIS AN INVALID NAME.—When I published my treatment of this genus in eastern and central North America[1], I completely overlooked *A. missouriensis* Greene.[2] Mr. C. V. Morton very kindly called this to my attention several years ago but I waited to correct the mistake until I had ample time to study the two species. Through the kindness of Dr. Theodore Just of Notre Dame University, I was able to obtain a photograph of the Greene TYPE (*B. F. Bush*, no. 31, Montier, Missouri) on which he based his description of the species. I also sent adequate specimens of *A. viridis* to Dr. Just who very graciously agreed to compare them with the type. This comparison was done by Mr. Merton J. Reed, one of Dr. Just's graduate students, and the results of his work clearly indicate that *A. viridis* and *A. missouriensis* are one and the same species. The latter name must, therefore, be taken up and the former reduced to synonymy.

Dr. Reed C. Rollins, visiting the Greene Herbarium in 1937, also recognized the identity of *A. viridis* and *A. missouriensis*. Likewise, he has annotated the specimens in the Gray Herbarium but has tactfully not publicly corrected my error, preferring to give me an opportunity to do so myself.

I am exceedingly grateful to Mr. Morton for his kindness in bringing to my attention this error and to Dr. Just for helping me to rectify it.

A. viridis var. *Deamii* thus becomes *A. missouriensis* var. **Deamii** (Hopkins), comb. nov.

LATHYRUS VENOSUS Muhl. var. MERIDIONALIS Butters & St. John. MCCURTAIN COUNTY: clay soil, 8 miles northeast of Broken Bow, *D. B. Lemon* (*ex. herb. Okla. A. & M. Coll.*).

Butters and St. John[3] list this variety as a southern one, citing specimens from North Carolina, Georgia, Louisiana and Texas, and from seeds collected in Tennessee and grown in the Harvard

[1] RHODORA **39**: 155–160. 1937.
[2] Fedde, Rep. Nov. Sp. **5**: 244. 1908.
[3] RHODORA **19**: 158. 1917.

University Botanical Garden. The Gray Herbarium has a specimen from Arkansas, but no citation from Oklahoma occurs in the manuals or floras nor do any of the checklists or works on the flora of Oklahoma mention it. The specimen in the Bebb Herbarium is one obtained in exchange with the Oklahoma A. & M. College, and was identified as *L. venosus*. Perusal of Butters and St. John's paper on the genus and comparative study with specimens in the Gray Herbarium indicate that the typical form of the species does not extend so far south. Our Oklahoma material should all be referred to the variety and inclusion of it in the native flora extends the range into a new state.

ERODIUM CICUTARIUM L'Hér. PITTSBURG COUNTY: waste places near McAlester, *Auval H. Brown*, no. 8.

An introduced weed, this plant has never been recorded from the state previously. Undoubtedly further collections will reveal it to be of rather common occurrence.

CNIDOSCOLUS TEXANUS AND C. STIMULOSUS; THEIR STATUS IN THE OKLAHOMA FLORA.—For several years I have been troubled by the identification of these two species and several of my colleagues asked me if it would be possible to study them and ascertain just what the ranges of each were, and whether one or both (or neither, there being an undescribed species of Mexican affinity in southwestern Oklahoma) occurred here. Accordingly, I took all the material in the Bebb Herbarium to Cambridge for study. The results of my investigation indicate that, of these two species, only *C. texanus* occurs in Oklahoma and Texas. *C. stimulosus* is strictly a coastal plain species,[1] occurring from Virginia south to Florida and on the gulf coastal plain to Mississippi and Louisiana. It is not represented in the Gray Herbarium from any Texas locality. *C. texanus* is the plant of the interior (Texas, Arkansas and Oklahoma), having larger flowers, a more heavily armed staminate calyx and more numerous spines on the stems and leaves. *C. stimulosus* has the flowers smaller, a nearly glabrous staminate calyx and fewer spines on the leaves and stems.

Small[2] correctly differentiated the two species but extended

[1] Fernald in RHODORA 44: 236–246. 1942.
[2] Flora, ed. 1: 706. 1903.

the range of *C. stimulosus* as far west as Texas. The range of *C. texanus* is properly given as "Arkansas and the Indian Territory to Texas". Cory[1] lists both species in Texas, giving the locality for *C. stimulosus* as the Rio Grande Plains (his Area no. 3, comprising all the counties in extreme southern Texas in the Rio Grande Valley).[2]

Stemen & Myers[3] list both species from Oklahoma. Their work is largely a compilation from Small's Flora as it pertains to this state, and where Small erred these authors likewise err.

G. W. Stevens' unpublished manuscript Flora of Oklahoma (original in the Widener Library of Harvard University; duplicate copy in the Library of the University of Oklahoma) also lists both species from our state but he, like Stemen & Myers, also followed Small to a large extent. Many of Stevens' records have been shown to be inaccurate and his determinations are likewise often insecure. Until a more thorough and complete knowledge of our native flora is obtained it would be unscientific to try to publish the Stevens manuscript.

CALLIRHOE INVOLUCRATA (T. & G.) Gray, forma **incisa,** n. f. Petalis apice incisis. CLEVELAND COUNTY: woodland copse near South Canadian River, Indian Springs, 4 miles south of Norman, *Hopkins*, no. 1296 (TYPE in Bebb Herb. Univ. of Okla.).

This unusual plant has the petals sharply incised to a depth of about 5 mm. instead of having them truncate at the apex as in the typical form of the species. I have seen no other plants like

[1] Catalogue Fl. Tex., 64. 1937.

[2] When I wrote Mr. Cory regarding the distribution of this plant several years ago and asked him for his personal field experiences with it, his reply was, in part, as follows:

"It has been my experience that practically all this material [from Texas] is of the species *texana*. [referring to the generic name *Jatropha*]. As I recall it, my only collection of the true *stimulosa* is from Maverick County, below Eagle Pass. Two or three years ago I collected a similar species, but apparently a different one, in the mountains near Sabinas Hidalgo, Nuevo Leon, Mexico. I did not get to preserve this specimen. Judging from the distribution of the two species, it would seem highly probable that the plant from along the Rio Grande would not be *stimulosa*. If it really is some distinct Mexican species, then we do not have any *stimulosa* in Texas. I should be inclined to suspect that you have only *texana* in Oklahoma. We have to rely upon the key in Small's Manual of the 1903 edition for the separation of these two species. All that I can say now is that we should have two species in Texas, one of which is most certainly *texana*, and the other probably a Mexican species." (letter dated 22 June 1940).

Although he listed *C. stimulosus* from Texas in his Catalogue in 1937, he apparently realized in 1940 that typical *C. stimulosus* is absent from the Texas flora, and therefore, should be written out of the Catalogue (page 64).

[3] Oklahoma Flora, 286. 1937.

it, outside of Indian Springs, where it appears to grow abundantly. Many plants have been found there.

VIOLA STRIATA Ait. MUSKOGEE COUNTY: deep, rich woods in dry soil, *Robt. Bebb*, no. 5251.

Among the most interesting of the new records based upon discoveries by the late Mr. Bebb, this little violet gave him the greatest pleasure. Its southwestern limit is thus extended into Oklahoma. He was always extremely modest and when I informed him of this new record for the state he insisted that the greatest possible care be exercised in checking its identity. He was invariably pleased at any of his "finds" but firm in his insistence that no credit be given him.

LYTHRUM LINEARE L. PITTSBURG COUNTY: swampy valley in deep woods, *J. E. McClary*, no. 49.

In studying the various species of this genus at the Gray Herbarium I was surprised to find a plant from Oklahoma with all the leaves opposite. Further, the opposite leaves on this specimen are narrowly linear and the longest is only 2.5 cm. The plant is obviously *L. lineare* but it is considerably more inland than its range would indicate. Pittsburg County, in southeastern Oklahoma, has a few representatives of the Coastal Plain flora (*Pinus echinata* being noteworthy), but ordinarily one does not expect to find plants characteristic of that region in the county. The western limit of *P. echinata* is just outside of McAlester (about 5 miles to the east on U. S. Highway 270), and it is likely that McClary, a former student at the University of Oklahoma, botanized in the outlying areas of the town extensively. His home was there.

The plant in question matches typical and authentically determined specimens, and it fits the descriptions in the manuals and floras. This station is far inland from the normal range of the plant and constitutes a new state record. Cory[1] gives its range in Texas as "Coastal Prairies" (his Area no. 2). This region constitutes only those counties along the Gulf of Mexico from the Louisiana state line to the vicinity of Corpus Christi. To reach the Oklahoma locality the migration of the species would have to have been via the Mississippi, Red and Boggy Rivers. Numerous creeks running south from Pittsburg County drain into the latter.

[1] Catalogue, 75.

ZIZIA APTERA (Gray) Fern. ADAIR COUNTY: hills in open woods, *Robt. Bebb*, no. 5210.

This collection, by the indefatigable Mr. Bebb, represents another extension of range southwestward. It is new to Oklahoma, the nearest station being in Missouri. I did not learn of this until after Mr. Bebb's herbarium had been brought to Norman and I began inserting his plants with those in the local herbarium. He identified the specimen as *Z. cordata*, but did not indicate that it constituted a new record. He thought that the herbarium at the University was much more complete than it was (or is now!) and did not realize that any of his contributions would be of major interest.

FRAXINUS PENNSYLVANICA VAR. AUSTINI IN OKLAHOMA.—Professor Fernald, discussing the varieties of this species[1] gives the range of this one from "Quebec to Manitoba, south to Nova Scotia, New England, northern New Jersey to upland of Virginia, New York, Ohio, Illinois and Iowa." In endeavoring to "order up" this genus in the Bebb Herbarium I found that several of our specimens[2] exactly fitted his description of this variety and that they would key out to none other. Consequently, I took them all to the Gray Herbarium for comparative study. They are doubtless this variety and I am therefore making what Professor Fernald indicates for all the American ashes, a "hopelessly tentative" determination. These specimens extend the range of the plant southward to the Wichita Mountains of southwestern Oklahoma. Inasmuch as these mountains harbor such eastern plants as *Arabis missouriensis* (in the greatest abundance, so that one almost thinks of it as a weed), *Acer saccharum* (in that region treated by most Oklahoma botanists as *A. grandidentatum*, but clearly not that, although further study

[1] RHODORA **40**: 452–453. 1938.

[2] *Waterfall*, no. 2935, along creek in open woods, Medicine Park, Wichita Mts., Comanche County; *Waterfall*, no. 2944, along ravine west of Medicine Park, Wichita Mts., Comanche County; *Mrs. J. Clemens*, no. 11,725a, Fort Sill, Comanche County. Mrs. Clemens was the wife of an Army Chaplain stationed there. She collected two specimens of this identical number but with different dates. The one in the Bebb Herbarium is dated June 22, 1916 (*a*), and the one in the Gray Herbarium bears the date 25 May 1916 (*b*). The latter specimen has the long samaras (over 4 cm.) of var. *typica;* the former has the shorter samaras of var. *Austini*. Collected about a month apart the two specimens were doubtless obtained at different localities on the post. Fort Sill was then, and is now, the largest Field Artillery School in the country and affords, within its own gates, many varied and unique collecting spots. Also, it is well within "gunshot" of the Wichita Mountains, being only a few miles away.

may reveal it to be merely an isolated variety of the typical New England sugar maple)[1], *Phryma Leptostachya* (the typical form) and *Arisaema Dracontium* (though perhaps not quite as "eastern" as the others, still not quite so "western" as the Wichitas), it is not unusual that one should also find this ash.

FRAXINUS TEXENSIS (A. Gray) Sargent. MURRAY COUNTY: open, xeric, calcareous outcrop in the center of Scott's Dome and adjacent to an old asphalt mine, Viola Limestone Formation, Arbuckle Mountains, *Hopkins*, no. 5305.

Locally abundant in the various limestone formations of the Arbuckles where it grows at the bottom of gullies and ravines, this plant appears to be unrecorded from the state. Closely related to *F. americana*, it is immediately differentiated by its smaller, more ovate leaflets which are usually fewer in number than in the former species, and by its shorter, smaller samaras. Asa Gray interpreted it merely as a variety of the white ash, but it is a tree of considerably lower stature and has numerous other characteristics which are adequate for maintaining it as a distinct species.

Although it is common in and nearly restricted to, the Arbuckles, there is one specimen in the Bebb Herbarium from Cherokee County, in northeastern Oklahoma (*Mr. and Mrs. E. L. Little, Sr.*, near Talequah, no. 149). Talequah is in a limestone area and it is quite likely that the specimen was found on

[1] Inasmuch as none of the authors prior to 1912 include *A. grandidentatum* in the flora of this state, it seems quite probable that the Wichita Mt. specimens were first identified (erroneously?) by G. W. Stevens (about 1915–16) as that plant, and that succeeding authors merely accepted his determination without further questioning. Sargent (Man., ed. 2: 693. 1922) cites Stevens as the authority for this record. Matoon (Forest Trees of Okla., ed. 1: 61. 1927) refers the plant to *A. saccharum* var. *grandidentatum* with the notation: "found in the Wichita Mountains of southwestern Oklahoma, but is rare and local." Later editions of this booklet (five in all) give it specific rank and all of them attribute it to the Wichitas. Jeffs & Little (Preliminary List of the Ferns and Seed Plants of Oklahoma: 71. 1930) include it. Stemen & Myers (Okla. Flora: 304. 1937) do likewise. But VanDersal (Handbook of Native Woody Plants of the U. S., U. S. D. A. SCS-TP-11: 32. 1936) very definitely, and I believe correctly, omits it from the Wichitas. However, in the later, published edition (the first one was only mimeographed) he includes it (Native Woody Plants of the U. S., U. S. D. A. M. P. no. 303: 40. 1938). The problem needs detailed study and no conclusions must be drawn at the present time. The above notes are included here merely to introduce the question as to the presence of the plant in the Wichitas. My own (and admittedly very brief) field experience with this tree has been just enough to convince me that it is probably only an ecological (or genetic) variant of the eastern sugar maple. Its occurrence in the Wichitas could easily be explained by the same hypothesis which accounts for its presence in Caddo Canyon, some 60 miles due north. This hypothesis was proposed by me several years ago (see RHODORA 40: 431. 1938).

calcareous rocks. If this is so (there is no indication on the label, however), it adds an additional link to my argument that an ancient flora existed on the thin limestones which were formed by the recession of the Comanchian Sea, in the southern Mid-Continent area of the United States. This idea was elucidated in an earlier paper[1] and was based on evidence illustrated by the present distribution of *Juniperus mexicana*[2], whose range is not unlike that of the Texas ash. The only northern Oklahoma station for the juniper (outside the Arbuckles where it too abounds) is in Mayes County which is not more than 25 miles north of the station for the ash. Both areas are in the Boone Limestone formation.

DICHONDRA REPENS Forst. var. CAROLINIENSIS (Michx.) Choisy. LEFLORE COUNTY: damp ground in rich woods, *Robt. Bebb*, no. 5403.

Again, Mr. Bebb told me nothing of this plant and I did not discover it until I began inserting his specimens. It is new to Oklahoma, being found elsewhere from Virginia to Florida, west to Texas, chiefly in the coastal regions. It was originally identified by the collector as *D. evolvulacea*—with a question mark—but I have checked my own determination. No previous records of its occurrence in our state are extant.

HEDEOMA ACINOIDES Scheele. MURRAY COUNTY: hillsides, near Prices Falls, in the Viola Limestone formation, *Tenney*, no. 170.

This plant constitutes another state record for the Oklahoma flora. Previous records indicate its occurrence in the adjacent states of Missouri, Arkansas and Texas, but none of the literature from this state mentions it and I am unable to find any specimens in any herbarium.

BRAZORIA SCUTELLARIOIDES Engelm. & Gray. MURRAY COUNTY: open, rocky pastures in limestone of the Frank's Conglomerate formation in Cowpen Canyon on the Ellsworth Collings' Bar-C Ranch, Arbuckle Mountains, *Hopkins*, no. 6330.

This very attractive little annual with its lilac-pink flowers looks so much like a *Physostegia* that I at first mistook it for one. However, all the members of that genus are perennials and over

[1] RHODORA **40**: 425–429. 1938.

[2] Which is not the correct name for the plant. The bibliography is essentially confused and *J. mexicana* is preoccupied. Until the correct name (or a new one) is found, the present epithet must suffice.

one foot high. This plant was scarcely 8 inches in height and had an annual root. Its identification adds another species to the state flora and also to that of the Arbuckle Mountains. As many times as I have botanized in those mountains in the spring, I have never happened to see this plant, much less to collect it. Yet on the day when I obtained it, the area was nearly carpeted with its pink flowers. It represents another extension northward from Texas where it occurs throughout the central and southern parts of that state. Only one specimen in the Gray Herbarium indicates the fact that it is a plant of calcareous soils, but in the Arbuckles it never grows anywhere except on limestone rocks.

GALIUM PROLIFERUM Gray. GREER COUNTY: damp soil, near Mangum, *Rotha Bull, sine numero.*

This specimen in the Bebb Herbarium was identified as *G. pilosum.* However, in checking the genus I was puzzled by the plant as well as several others resembling it superficially, and therefore took the entire lot to the Gray Herbarium for further study. This herbarium sheet is the only representative of the species in our Herbarium and, likewise, constitutes a new state record, not being previously found north of Texas where it occurs in the Trans-Pecos and Edwards Plateau areas (nos. 5 & 6 in Cory's Catalogue). Mangum is in extreme southwestern Oklahoma and possesses many plants of south Texas affinities in its rather diversified flora.

GALIUM TEXENSE IN OKLAHOMA.—In the Bebb Herbarium there are four specimens of this interesting species, variously identified as *G. proliferum, G. pilosum* and *G. virgatum.* While studying the material in the Gray Herbarium, it was obvious that they should all be referred to *G. texense* Gray, and therefore they constitute another new record for our flora, the plant having previously been unrecorded from north of Texas. Three of those specimens are from the Wichita Mountains in the southwestern part of the state[1]; the other is from Mangum in Greer County (*Bull, sine numero*). Miss Bull wrote her thesis for the M.S. degree on the "Flora of Greer County" (unpublished) and although she is represented in the Bebb Herbarium by innumerable specimens, it is very unfortunate that she did not number all of

[1] *Mrs. J. Clemens*, no. 11,792, Fort Sill, Comanche Co.; *Waterfall*, no. 2923, in field among granite boulders near top of Mt. Scott, Wichita Mts., Comanche Co.; *Rotha Bull*, no. 47, Wichita Mts., Comanche Co.

them and that her descriptions of habitat were so sketchy. Greer County is adjacent to the Texas panhandle and Miss Bull's work is the only representation from that area, except for the collections from one trip made hastily in 1914 by the late G. W. Stevens.

University of Oklahoma
Norman, Oklahoma

A Flora of Kentucky.—It is a great pleasure to welcome to the growing array of state-floras one which assembles information on the distribution within the state of the flowering plants of Kentucky. Professor E. Lucy Braun[1] has given us her knowledge of local ranges and many critical comments. Divided between differing judgments of specific values, she has often avoided umpiring by following extended works on groups without noting dissenting evaluations. She thus accepts Hitchcock's Manual for the *Gramineae;* and all the members of *Panicum* for which she has found records appear, consequently, with no intimation that several close students have independently merged as one species, for example, *P. huachucae, Lindheimeri* and *tennesseense,* or, similarly, that in *Paspalum,* competent students have protested the keeping apart as species *P. circulare* and *P. laeve.* In these more technical groups the author has, obviously, not been in a position to decide. In groups more familiar to her she has made pertinent notes, like the failure of the leaves of the *Arisaema triphyllum* series to hold consistently to green or glaucous lower surfaces, or the ecological phases of *Aquilegia canadensis* failing to maintain their individuality when grown in similar habitats; and in a large number of cases, where no extended volume was leaned upon, recent critical studies of individual genera or species have been accepted. The citations in these cases greatly add to the reference-value of the *Catalog.* The great amount of collecting and of study of literature and the larger and older herbaria still to be done before the full content of the flora of the state is enumerated in one catalogue is evident from there being no mention of such weedy plants (found north, south, east and west of Kentucky) as *Camelina, Raphanus, Brassica* (except *nigra)* and *Erysimum cheiranthoides,* or of the weedy *Trifolium dubium,* which was sent to Asa Gray in 1855 by Short with the comment: "A volunteer in my garden and grass lots—never observed 'till this summer. Should be embraced among Kentucky plants." In *Trifolium,* furthermore, one misses any native species. They are doubtless local, but in the Gray Herbarium there are characteristic specimens from Kentucky of the native *T. reflexum* (three stations) and a fine specimen from Lexington, *Short,* of the native *T. stoloniferum.* In fact, both these natives were in Short's published *Catalogue* of 1833. In the first two-thirds of the *Archaechamydeae* one misses other noteworthy natives of Kentucky: *Stellaria fontinalis* (Short & Peter) Robinson, based on *Sagina fontinalis* Short & Peter from "cliffs of the Kentucky river and Elkhorn creek"; *Clematis glaucophylla*

[1] E. Lucy Braun. An Annotated Catalog of Spermatophytes of Kentucky. Copyright 1943 by E. Lucy Braun. Planographed. 161 pp.

Small (several stations represented in the Gray Herbarium); *Lesquerella globosa* (Desv.) S. Wats., generally identified with *Vesicaria Shortii* Torr. & Gray, the type of which came from "Banks of Elkhorn Creek, near Frankfort, Kentucky, *Short!*"; *Apios Priceana* Robinson, one of Miss Price's notable discoveries in Warren County; and *Centrosema virginianum* var. *ellipticum* (DC.) Fernald, from Wayne County—see RHODORA, xliii. 588 (1941). These and other similar cases indicate the large amount of work yet to be done in drawing together the scattered items on the flora of Kentucky. The author of the present Catalog has the energy and enthusiasm. We may look hopefully for a fuller record of old, as well as new Kentucky collections from her pen.—M. L. F.

A CHECK-LIST OF KENTUCKY PLANTS.—Another catalogue of vascular plants of Kentucky has been published by Prof. Frank T. McFarland. It is only a check-list and makes no claim to be anything more.[1] Genera and species are arranged alphabetically under their families; no further data of any kind and no synonymy are given. It is, however, a good check-list. There has been an obvious and for the most part successful effort to take into account the results of recent taxonomic work. The list should be useful and reliable for any purpose which such a list can serve.

Neither Prof. Braun nor Prof. McFarland has been able to do much with the flora of western Kentucky, and both are conscious that their catalogues are far from complete. McFarland's is, to some extent, deliberately so: he has thought best to base his records on specimens in the herbaria of the University of Kentucky and the Kentucky Agricultural Experiment Station and to disregard unverified reports in literature. The result is that the two catalogues are reciprocally incomplete. McFarland's, for instance, includes the pteridophytes and most of the species noted by Prof. Fernald as omitted from Braun's; and Braun's contains, along with a good many recent discoveries of her own, presumably trustworthy reports from literature (like Mackenzie's records of *Carex Buxbaumii* and *C. comosa*) not noticed by McFarland. With the knowledge that the data back of McFarland's undocumented records exist in the herbaria which he used, the two catalogues can be used to supplement one another.—C. A. W.

[1] FRANK T. MCFARLAND. A Catalogue of the Vascular Plants of Kentucky. Reprinted, without change of pagination, from Castanea, vii. 77–108 (1942).

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXLVIII

M. L. Fernald

(*Continued from page 258*)

V. STUDIES IN NORTH AMERICAN SPECIES OF SCIRPUS

(Plates 762–767)

The American Representative of Scirpus pumilus (Plates 762–764).—One of the rarest or most localized sedges of North America is the tiny plant with solitary terminal spikelet, belonging in *Scirpus*, § *Baeothryon* and passing for nearly forty years in America as the Eurasian *S. alpinus* Schleicher (1828) and subsequently as the identical *S. pumilus* Vahl (1806). First recorded as American by Britton in Trans. N. Y. Acad. Sci. xi. 75 (1892) as *S. alpinus* from the "Rocky Mountains", *Hall & Harbour*, and from Moreley in the Canadian Rocky Mountains, the species next attracted attention from its discovery on Anticosti Island and the adjacent Mingan Islands of Saguenay County, Quebec, and was the subject of one of the interesting articles by Marie-Victorin, in Trans. Roy. Soc. Can., ser. 3, xxiii. pt. 2, sect. V. 25 (1929). Somewhat later, in Rhodora, xxxiii. 23, 24 (1931), I pointed out that the name *S. pumilus* Vahl antedates *S. alpinus* Schleicher and I then recorded additional stations in the Canadian Rocky Mountains; and more recently Beetle, in Am. Journ. Bot. xxviii. 421 (1941), has maintained *S. pumilus* as American: "Mountain meadows of Eurasia and North America", he citing American plants of Quebec (Anticosti and the Mingan Islands), Saskatoon, Saskatchewan, Alberta and Colorado. The habitat, "mountain meadows", while perhaps applying in the Rocky Mountains, is hardly appropriate for the Quebec area, with Anticosti rarely attaining a height of 175 m.[1] and the Mingan

[1] "les plus hautes plateaux cités par eux ne dépassent pas 150 et 175 metres"—Despêcher and Combes as quoted by Schmidt, Monographie de I'Ile d'Anticosti, 10 (1904).

Another member of § *Baeothryon*, the flat-leaved woodland *Scirpus planifolius* Muhl., is cited by Beetle, l. c. 174, from "Vermont: Willoughby, *W. Boott* in 1863". William Boott's herbarium is incorporated in the Gray Herbarium. There is there no Vermont material of *S. planifolius* from him, and Kennedy and others who intimately knew the Willoughby region did not know it there. Dole lists it only from

Islands still lower, while Saskatoon is well to the east of the mountains, in the flat Canadian prairie.

Ever since Britton's identification of the Rocky Mountain plant with *S. alpinus* Schleicher or *S. pumilus* Vahl of central and southeastern Europe, eastward into Persia and central Asia, we have accepted the identification without question. The plants of Eurasia are at least two quite different species, or perhaps geographic varieties, while some of the Asiatic material, that of alpine regions (4305–5200 m.) of Tibet may be distinct. This Tibetan plant may well be *Isolepis oligantha* C. A. Meyer, Mém. des Sav. Étrang. Pétersb. i. 197, t. 1 (1831); but until some one who has more adequate material and who can study Meyer's Siberian type can check it, the Tibetan plant may wait.

True *Scirpus pumilus* of the alpine regions of south-central and -eastern Europe, thence into Persia and Siberia (our PLATE 762) is subcespitose or quite densely cespitose (as shown by Reichenbach and others), with short stoloniferous offsets which promptly send up erect tufts of culms; the lowest scale of the spikelet often has the green midrib prolonged (FIGS. 3 and 4) as a green and blunt mucro; the anthers (FIGS. 2 and 3) have the connective prolonged as a distinct subulus; the achenes (FIGS. 6–8) are rather slenderly ellipsoid-obovoid, 1.6–1.8 mm. long, 0.4–0.5 mm. broad, subequilaterally trigonous (FIGS. 6 and 9) and usually broadly rounded to truncate at the sessile base; while all but the lowermost scales of the spikelet have thin scarious margins.

Fully 2100 km. to the north, within the Arctic Circle, there is a plant, occurring on Porsanger Fjord (south of Cape North) in northernmost Norway which is identified in current Scandinavian floras as *Scirpus pumilus*. This plant (PLATE 763, FIGS. 1–5) is extensively creeping, with very elongate filiform rhizomes and with small and scattered tufts of culms. Its anthers (FIG. 2) and achenes (FIG. 4) are like those of *S. pumilus*, except that the achenes are longer (2–2.2 mm. long); but its scales are much

---

two Vermont stations, Mt. Philo (Addison County) and North Pownal (Bennington County). It has also been collected in Arlington, Bennington County. These known stations are along the warm southwestern border of Vermont, not, like Willoughby, near the northeastern corner. It is probable that the Willoughby record of *S. planifolius* arose from *S. pauciflorus* Lightf., now usually treated as *Eleocharis pauciflora* (Lightf.) Link (var. *Fernaldii* Svenson) which abounds at Willoughby and was there collected by Wm. Boott in 1863.

Photo. B. G. Schubert.

SCIRPUS PUMILUS: FIG. 1, habit, × 1; FIGS. 2–4, spikelet, × 4; FIG. 5, disintegrated spikelet, showing broad scarious margin of scale, × 10; FIG. 6, achene and its cross-section, after *Schroeter;* FIGS. 7 and 8, achenes, × 10; FIG. 9, looking down upon summit of achene, × 10.

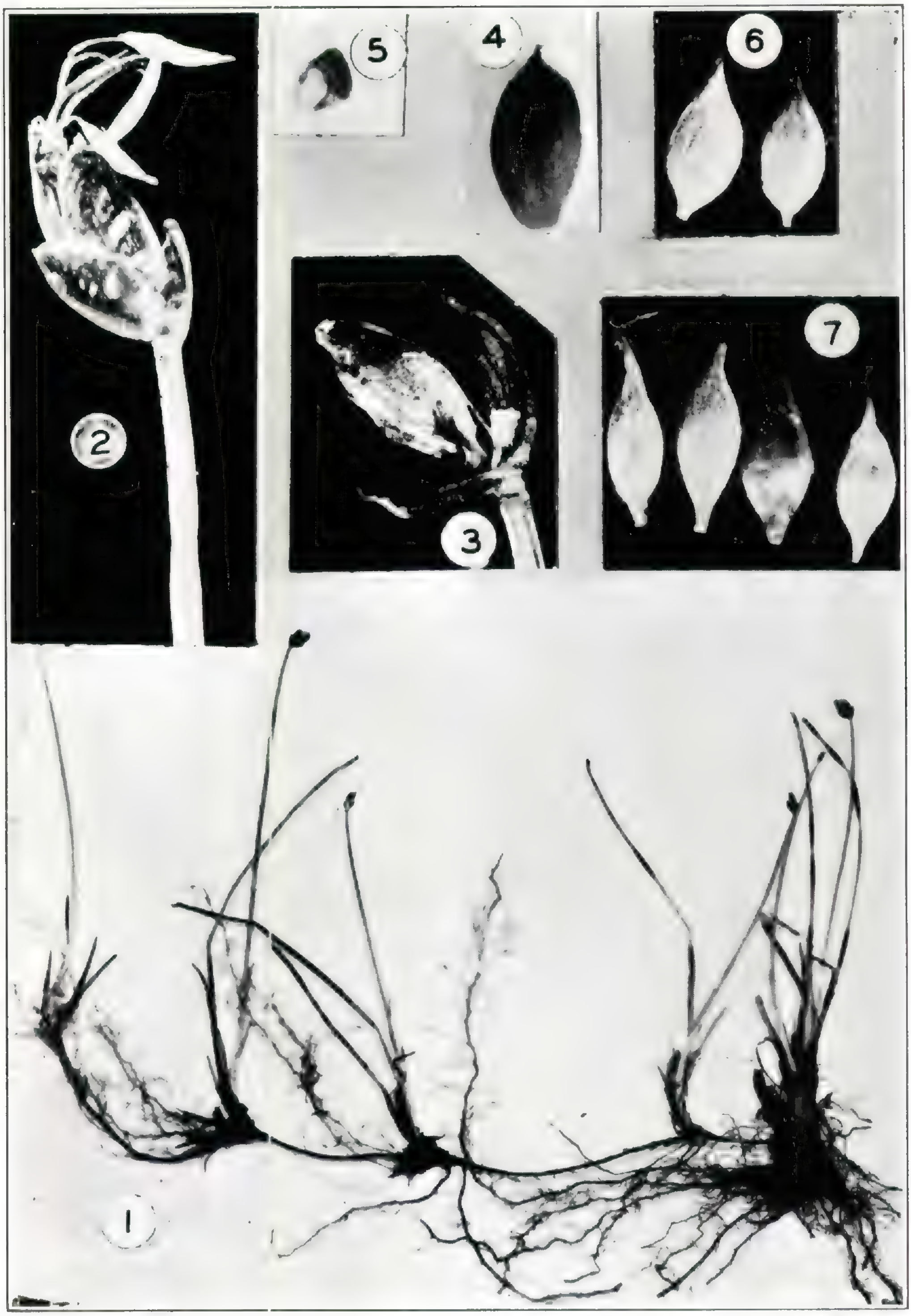


Photo. B. G. Schubert.

SCIRPUS EMERGENS: FIG. 1, topotype, × 1; FIG. 2, spikelet, × 10, FIG. 3, disintegrated spikelet, showing firm scales, × 10; FIG. 4, achene, × 10; FIG. 5, looking down upon summit of achene, × 10.

S. RUFUS: FIG. 6, achenes, × 10.

S. RUFUS, var. NEOGAEUS: achenes, × 10.

firmer and broader than in true *S. pumilus* and the latter have the margins hardly if at all scarious (FIG. 3). Furthermore the lowest scale (FIG. 2) is nearly like the others, without the green mucro strongly excurrent. Differing so markedly from typical *S. pumilus*, it was beautifully described as *Trichophorum emergens* Norman in Soc. Reg. Sc. Norveg. v. 319—repr. as Spec. Loc. Nat. 79 (1868)—and as abundant on the sandy inundated shore in Porsangria. "Vaginae basilares culmi ut in *Trichophoro caespitoso*, a quo rhizomate repente, stolonifero, fasciculos pauciculmeos immo culmos solitarios huc illuc emittente, recedit. Sub accessu maris inundatur, sub recessu emergit". So different is this Finmark plant of inundated tidal shores from the more cespitose one of the southern alpine areas that it should certainly be kept apart.[1] Even the original editors of *Index Kewensis*, who did not hesitate to reduce species they did not understand, were baffled by *Trichophorum emergens*, appending after the citation "(Quid?)—Norveg."

As stated and as shown in the plates, the anthers in the Eurasian *Scirpus pumilus* and *S. emergens* have prominently excurrent connectives and the achenes are subequilaterally trigonous, while in *S. pumilus* the lowest scale often has the midrib excurrent as a mucro; and the blunt scales of the arctic tidal-shore *S. emergens* are subcoriaceous and scarcely scarious-margined. When we turn to the North American plant (PLATE 764) which has passed as *S. pumilus* we find a habit midway between those of the two European species, the culms tufted, sometimes without but usually with slender and elongate rhizomes and scaly stolons. The American plant on superficial examination might easily be thought to stand somewhat intermediate between those of Eurasia. In our plant the scales of the spikelet are as thin as in *S. pumilus* but the lowest (FIGS. 2 and 3) has the midrib included, not exserted; the anthers (FIGS. 2 and 4) merely taper to tip, with the connective not exserted; and the achene (FIGS. 5–10) is plano-convex, broad and flat on the inner face, gently arching to merely umbonate on the back. The ripe achenes (FIGS. 5–7) are broadly ellipsoid-oblong, only 1.2–1.5 mm. long but 0.8–1.2 mm. broad, and gradually rounded to

[1] SCIRPUS **emergens** (Norman), comb. nov. *Trichophorum emergens* Norman in Soc. Reg. Sc. Norveg. v. 319—repr. as Spec. Loc. Nat. 79 (1868). PLATE 763, figs. 1–5.

base or sometimes substipitate. Differing in these minute but morphologically important characters from the Eurasian series, the North American plant is clearly an endemic species. Our fullest representation is the abundant series from Anticosti and the Mingan Islands, collected by Bros. Marie-Victorin and Rolland-Germain. I am greatly pleased to have this opportunity to associate with a plant of that area the name of a modest and self-effacing botanist who has done much in his earnest and discriminating way to bring to our knowledge the rarer plants of Quebec, Brother Rolland-Germain.

SCIRPUS (§ BAEOTHRYON) **Rollandii,** sp. nov. (TAB. 764). Planta habitu foliis culmisque ut in *Scirpo pumilo* sed valde stolonifera; culmis laxe cespitosis vel subsolitariis; spiculis ellipsoideo-ovoideis 3–4 mm. longis, subteretibus; squamis ovatis obtusis vel subacutis brunneis vel rufescentibus subcoriaceis margine scariosis; antheris 1.5 mm. longis apice attenuatis; achaeniis nigrescentibus late oblongo-ellipticis, 1.2–1.5 mm. longis 0.8–1.2 mm. latis, plano-convexis dorso leviter convexo vel umbinato.—QUEBEC: Archipel de Mingan: rivages calcaires, Ile Sainte-Geneviève, 9 août, 1925, *Victorin & Rolland*, no. 20,220; corniches calcaires du côté du large, Ile Sainte-Geneviève, 22 juillet, 1926, *Victorin & Rolland*, no. 25,785 (TYPE in Herb. Gray.); rivages calcaires, Ile à Marteau, 23 juillet, 1926, *Victorin & Rolland*, no. 25,940; parties élevées et découvertes surtout dans les sentiers de renard, Grande Ile à la Vache Marine, 19 juillet, 1926, *Victorin & Rolland*, no. 25,782; tundra calcaire parmi les Ericacées et les *Salix* nains, Grande Ile à la Vache Marine, 3 août, 1928, *Victorin & Rolland*, no. 28,374. Anticosti: sur les platières argilo-calcaires au-dessus des gorges, Rivière Chicotte, 15 août, 1925, *Victorin & Rolland*, no. 25,783; sur les platières à plusieurs milles en haut des gorges, Rivière Chicotte, 24 juillet, 1927, *Victorin & Rolland*, no. 27,517; sur les platières avec divers *Antennaria*, 19 août, 1926, *Victorin & Rolland*, no. 25,784; sur les platières en haut des gorges, Rivière au Fusil, 20 juillet, 1927, *Victorin & Rolland*, no. 27,518; sur les platières près de la mer, 25 juillet, 1927, *Victorin & Rolland*, no. 27,516; éboulis argilo-calcaire, le long de la mer, à l'est de la rivière, Rivière la Loutre, 6 août, 1926, *Victorin & Rolland*, no. 25,781. SASKATCHEWAN: depressed alkaline bog, Sutherland, Saskatoon, June 1, 1938, and July 24, 1939, *W. P. Fraser*. ALBERTA: marsh, Devil's Lake, alt. 4600 ft., Banff, July 5, 1907, *Butters & Holway*, no. 50. COLORADO: "Rocky Mt. Alpine Flora, Lat. 39°–41°", 1862, *Hall & Harbour*, no. 583.

PLATE 762 shows details of SCIRPUS PUMILUS Vahl: FIG. 1, habit, × 1, from Prov. Semipalavitinsk, western Siberia, May 21, 1920, *O. Simonova &*

T. Batueva; FIG. 2, spikelet, × 10, from same collection; FIG. 3, spikelet, × 10, from Mont Cenis, Savoie, July 27, 1855, *Perrier;* FIG. 4, spikelet, × 10, from *Simonova & Batueva;* FIG. 5, disintegrated spikelet, showing broad scarious margin of scale, × 10, from Zermatt, July, 1882, *Christ;* FIG. 6, achene and its cross-section, after *Schroeter*, Pflanzenl. der Alpen, fig. 174 (1923); FIG. 7, achene, × 10, from Mont Cenis, *Perrier;* FIG. 8, achene, × 10, from Zermatt, *Christ;* FIG. 9, looking down on summit of achene, × 10, from Zermatt, *Christ.*

PLATE 763, FIGS. 1–5. S. EMERGENS (Norman) Fernald: FIG. 1, habit, × 1, from Porsangar Fjord, Finmark, July 9, 1898, *A. L.;* FIG. 2, spikelet, × 10, from same collection; FIG. 3, disintegrated spikelet, showing firm scales, × 10, from Borself, Porsanger, August 15, 1899, *Ove Dahl;* FIG. 4, achene, × 10, from *Dahl;* FIG. 5, looking down on tip of achene, × 10, from *Dahl.* FIG. 6, *S. rufus* (Huds.) Schrad.: achenes, × 10, from Skåne, Sweden, July 14, 1928, *Erik Asplund.* FIG. 7, *S. rufus*, var. *neogaeus:* achenes, × 10, from the TYPE.

PLATE 764, S. ROLLANDII Fernald: FIG. 1, habit, × 1, from the TYPE; FIGS. 2 and 3, spikelets, × 10, from TYPE; FIG. 4, disintegrated spikelet, showing anthers, × 10, from TYPE; FIG. 5, achene, × 10, from Ile à la Vache Marine, Archipel de Mingan, Quebec, *Victorin & Rolland*, no. 28,374; FIG. 6, achene, × 10, from Rivière Chicotte, Anticosti, *Victorin & Rolland*, no. 27,517; FIG. 7, achene, × 10, from Saskatoon, Saskatchewan, July 24, 1939, *W. P. Fraser;* FIG. 8, looking down on tip of achene in fig. 5, × 10; FIG. 9, similar view, × 10, of achene in fig. 6; fig. 10, similar view, × 10, of achene in FIG. 7.

SOME NORTH AMERICAN MEMBERS OF SCIRPUS, § LACUSTRES (PLATES 765 and 766).—

SCIRPUS VALIDUS Vahl, var. **creber,** var. nov. (TAB. 765, FIG. 4–7), spiculis ovoideis 5–9 mm. longis; squamis costa margineque exceptis glabris lucidis achaenio maturo vix superantibus; antheris deinde subulato-appendiculatis; perianthio achaenium subaequante; achaeniis 1.7–2.5 mm. longis 1.3–1.5 mm. latis.—Newfoundland to British Columbia, south to Nova Scotia, New England, Long Island, Georgia, Tennessee, Missouri, Oklahoma, Texas, New Mexico, northern Mexico and California. TYPE: salt-marsh, Fisher's Island, New York, August 10–15, 1920, *Harold St. John*, no. 2581 (in Herb. Gray.).

Forma **megastachyus,** f. nov. (TAB. 765, FIG. 8), spiculis lineari-cylindricis 9–15 mm. longis; achaeniis 2.3–2.8 mm. longis 1.4–1.8 mm. latis.—Scattered through the range of var. *creber;* the following are characteristic. NOVA SCOTIA: Truro, *Fernald & Wiegand*, no. 2720. MAINE: Lincolnville, *G. B. Rossbach*, no. 238. MASSACHUSETTS: York Pond, Canton, July 8, 1894, *Kennedy;* Eastham, *F. S. Collins*, no. 1293; Wakeby Pond, Sandwich, September 16, 1916, *Harger & Woodward.* CONNECTICUT: East Windsor, August 21, 1904, *Bissell.* VIRGINIA: west of Toano, James City County, *R. W. Menzel*, no. 89. MICHIGAN: New Buffalo, *Lansing*, no. 3281. IOWA: Lost Lake Township, Clay County, *Ada Hayden*, no. 9195. NORTH DAKOTA: Mandan, *F. P. Metcalf*, no. 374. NEBRASKA: St. Paul, July 24, 1909, *J. M. Bates.* KANSAS: Joy Creek, Osborne County, July 11, 1894,

Shear, no. 239 (TYPE in Herb. Gray.); Riley Co., June 21, 1895, *J. B. Norton*. TEXAS: Dallas Co., July, 1877, *Reverchon;* El Paso County, *Cory*, no. 1255. ALBERTA: Cree (Mamawi) Creek, Wood Buffalo Park, *Raup*, no. 1980. OREGON: St. Paul, *J. C. Nelson*, no. 1692; Salem, *Nelson*, no. 3307.

Scirpus validus (PLATE 765, FIGS. 1–3) was described by Vahl, Enum. ii. 268 (1806), its "*Habitat* in Caribaeis", with a clear diagnosis and a remarkably complete description, he distinctly saying "squamis dorso villosis". It is the plant of eastern tropical America[1] which differs at once from the common plant of the United States and Canada in several points. Its inflorescence (FIG. 1) is usually stiffer than in the common North American plant, only exceptionally with arching and pendulous rays and pedicels, although the more northern plant may have the inflorescence as stiff as in *S. acutus* Muhl. Typical *S. validus* may, as originally described, have the scales of the spikelets villous or they may be glabrescent or even glabrous except for the keel and the fimbriate-ciliolate margin. In none of the tropical and subtropical American material do the achenes show beyond the scales; the scales strongly cover them and are nearly twice as long. The perianth consists of very delicate bristles remotely retrorse-setulose chiefly above the basal third and commonly overtopping the achene. The connective of the anther (FIGS. 2 and 3) projects as a triangular-ovate sessile tip, though sometimes becoming elongate. North of tropical America true *S. validus* is frequent or common in Florida and there is material in the Gray Herbarium with the stereotyped and possibly too inclusive label "Santee Canal, South Carolina, *Ravenel*".

From genuine tropical and subtropical *Scirpus validus* our var. *creber* differs in its often more lax inflorescence (FIGS. 4 and 5), the backs of the scales glabrous, the scales barely covering or when they are ripe (FIG. 5) not wholly covering the achenes; the perianth (FIG. 7) of usually coarser and rather shorter bristles which are copiously retrorse-setose; and the anther (FIG. 6) with the slender tip becoming prolonged. Some material from the southeastern states and some from Bermuda is so transitional

[1] The citation by Beetle in Am. Journ. Bot. xxviii. 695 (1941) of Bermuda, Haiti, Porto Rico, Jamaica and Cuba as the "EAST INDIES" and his statement of broad range (p. 693), "common throughout North America, and bordering the Pacific basin", with the only South American specimens cited coming from Uruguay and Argentina, suggest need of more precise knowledge of geography.

Photo. B. G. Schubert.

Scirpus Rollandii: fig. 1, type, × 1; figs. 2 and 3, spikelets of type, × 10; fig. 4, disintegrated spikelet from type, showing anthers, × 10; figs. 5–8, achenes, × 10; figs. 8 10, looking down upon summits of achenes, showing plano-convex outline, × 10.

Photo. B. G. Schubert.

SCIRPUS VALIDUS: FIG 1, inflorescence, × 1; FIG. 2, spikelet, × 5; FIG. 3, achene and elongate bristles, × 10.

Var. CREBER: FIG. 4, inflorescence of type, × 1; FIG. 5, mature spikelets, showing protruding achenes, × 5; FIG. 6, flowering spikelets, × 5; FIG. 7, achene and subequal bristles, × 10.

Var. CREBER, FORMA MEGASTACHYUS: FIG. 8, inflorescence of type, × 1.

that I am treating the common plant of the United States and Canada as a strong geographic variety, rather than as a species. In its prolonged and linear-cylindric spikelets up to 1.5 cm. long var. *creber*, forma *megastachyus* (FIG. 8), when its inflorescence is contracted, might be mistaken for *S. acutus*. In fact, by the recently published key to species of this section ("Spikelets ovoid . . . *S. validus*"; "Spikelets subcylindric . . . *S. acutus*"[1] and the accompanying descriptions ("spikelets 5–10 mm. long, . . . ovate" for *S. validus;* "spikelets 0.7–2 cm. long, . . . ovate-acute to cylindrical" for *S. acutus*) one could hardly place most specimens under *S. validus;* nevertheless several specimens, including the type, of forma *megastachyus* were cited as good *S. validus*. Accompanying the elongation of spikelet the achene of forma *megastachyus* is enlarged, achenes from the form running considerably larger than in typical var. *creber*.

In connection with *Scirpus validus*, var. *creber* two names have to be considered, because they are cited by Beetle as synonyms under his all-inclusive *S. validus*. These are *S. orgyalis* Raf. Annals of Nature [not "Amer. Nat." as cited in the recent paper], 16 (1820) and *S. lacustris*, var. *condensatus* Peck, N. Y. State Mus. Rep. no. 53: 853 (1900). Rafinesque's *S. orgyalis* of "creeks and rivers of New York and Pennsylvania", had little of specific character in the brief description except "spikes lateral under the apex, glomerated, ovate, sub-sessile; scales ovate, mucronate, brown, arachnoidal". What he had we do not know. He intended his name to apply to anything North American of the *lacustris* group. The "glomerate . . . sub-sessile" spikes with "arachnoidal" scales could as well, if not better, apply to *S. acutus* Muhl. (1842) which occurs in New York and western Pennsylvania and which often has villous scales, while those of the *S. validus* of that region have the scales glabrous except for keel and margin.

Peck was not differentiating between the three species of § *Lacustris* which occur in New York State. His "**S. lacustris condensatus** *n. var.*" was described: "Heads of the panicles sessile or on very short pedicels, forming a dense cluster about 1 inch long and broad. Otherwise as in the common form. Lime

[1] Beetle, l. c. 692 (1941).

Lake. August. F. E. Fenno." According to House, N. Y. State Mus. Bull. no. 254: 147 (1924) the Fenno plant is *S. heterochaetus*, a species which usually has a lax and open panicle and which differs from *S. validus* in its very pale and solitary spikelets, its trigonous achene, etc. Even if *S. lacustris condensatus* were an unusual form of *S. validus* it would be quite ridiculous to take up the name, intended for a trivial form, for the transcontinental plant with open and loosely forking panicles. Extreme literalists might do so, but the intent of the original author was obvious; the rules of nomenclature were not intended to foster absurdity, if they do, it is time to change them.

S. Steinmetzii, sp. nov. (TAB. 766, FIG. 1–7). Planta statura habituque ut in *Scirpo heterochaeto;* spiculis ellipsoideo-ovoideis obtusis 5–7.5 mm. longis 4–5 mm. crassis fulvis; squamis scarioso-membranaceis fulvis acuminatis glabris, margine apiceque villoso-ciliatis, aristo breve; antheris apice triangulari-ovatis; stylo 2-partito; achaeniis plano-convexis albescentibus elliptico-obovatis vel subrotundatis 2.5–2.8 mm. longis; setis 1 vel 2 vel 0 tenuissimis brevibus.—MAINE: bank and shore of sluggish stream, Passadumkeag Stream, Passadumkeag, Penobscot County, August 12, 1937, *F. H. Steinmetz*, no. 355 (TYPE in Herb. Gray.; ISOTYPE in Herb. Univ. of Maine), September 1, 1938, *Steinmetz*, July 29, 1942, *Steinmetz & Gashweiler*, specimens originally and tentatively placed with *S. heterochaetus* Chase; shallow water near shore of river, Passadumkeag River at Hathaway Bridge, Passadumkeag, August 5, 1940, *Ogden & Wright*, no. 2345.

Scirpus Steinmetzii, with which it is a great pleasure to associate the name of the leader of botanical exploration in Maine and discoverer of the plant, is like *S. heterochaetus* only in having a prolonged basal leaf and in its lax inflorescence with no tendency to the formation of glomerules. *S. heterochaetus* has slender pale green to whitish-brown lanceolate to slenderly ellipsoid acute or subacuminate spikelets 0.75–2.3 cm. long; its pale scales are firm to subcoriaceous and deeply emarginate at tip; its styles mostly 3-cleft, its achenes trigonous. It is a species of calcareous or alkaline waters; and it was beautifully illustrated by Mrs. Chase when she published it in RHODORA, vi. 70, t. 53, fig. *d* (1904). *S. Steinmetzii*, on the other hand, has the reddish to purple-brown plump-ovoid obtuse spikelets only 5–7.5 mm. long; the thin and almost scarious scales tapering to the awn

(not deeply emarginate) and heavily villous-ciliate (rather than slightly or hardly so) at margin; the style is 2-cleft and the strongly flattened achene plano-convex, merely slightly convex on the back. It should, therefore, be confidently watched for in the extensive lake-strewn area which extends from the Penobscot across Hancock and Washington Counties, Maine, into southwestern New Brunswick.

From *Scirpus validus*, var. *creber* the newly described *S. Steinmetzii* is distinguished by its non-glomerulate spikelets, the scales greatly overtopping the achenes (as in tropical *S. validus*), but with tapering (rather than broadly rounded and emarginate) tip, the anther-connective with a triangular sessile terminal appendage, the bristles fewer and short or wanting, and the persistent old filaments very broad and ribbon-like.

In PLATE 765, FIGS. 1–3 are of typical SCIRPUS VALIDUS from Cordillera Septentrional, prov. Puerto Plata, Sabaneta, in Caño Hondo, Civ. Santo Domingo, Hispaniola, *Ekman*, no. 14,549: FIG. 1, inflorescence, × 1; FIG. 2, spikelet, showing blunt anther, × 5; FIG. 3, achene, showing elongate bristles and an anther, × 10. FIGS. 4–7, var. CREBER: FIG. 4, inflorescence of TYPE, × 1; FIG. 5, mature spikelets, showing protruding achenes, × 5, from Litchfield, New York, *Haberer*, no. 2228; FIG. 6, flowering spikelets, showing apiculate anthers, × 5, from Dixville Notch, New Hampshire, July 27, 1895, *E. F. Williams;* FIG. 7, achene, showing bristles, from TYPE, × 10. FIG. 8, inflorescence of TYPE of var. CREBER, forma MEGASTACHYUS, × 1.

In PLATE 766 FIGS. 1–7 are of SCIRPUS STEINMETZII, all from the TYPE series: *fig.* 1, inflorescences, × 1; FIG. 2, axis of inflorescence, × 3; FIGS. 3 and 4, spikelets, showing long scales and blunt anthers, × 5; FIGS. 5 and 6, achenès, with single perianth-bristle and broad filaments, × 10; FIG. 7, achene viewed from above (looking down on beak), × 10. FIGS. 8–10, S. HETEROCHAETUS, from Selkirk, Oswego County, New York, *Fernald, Wiegand & Eames*, no. 14,192: FIG. 8, spikelets, × 5; FIG. 9, achene, × 10; FIG. 10, achene, viewed from above, × 10.

SOME AMERICAN SPECIES AND VARIETIES OF SCIRPUS (PLATES 763, figs. 6 and 7, and 767).—SCIRPUS RUFUS (Huds.) Schrad., var. **neogaeus,** var. nov. (TAB. 763, FIG. 7), achaeniis fusiformi-lanceolatis 4.5–5.5 mm. longis 1–1.7 mm. latis valde stipitatis rostratisque.—Saline to brackish, rarely fresh marshes, Newfoundland and shores of Gulf of and lower River St. Lawrence, Quebec, south to southwestern Nova Scotia and southwestern New Brunswick; salt marshes from Churchill to Red Deer River, lat. 53°, Manitoba. TYPE: near Hospital Point, Grindstone Island, Magdalen Islands, July 18, 1912, *Fernald, Bartram, Long and St. John*, no. 6968 (in Herb. Gray.).

In habit, foliage, spikes and spikelets the American material of *Scirpus rufus* (*Blysmus rufus* (Huds.) Link) is quite like the plant of northern Europe and it shows the same diversity of

involucre, oftenest with it essentially obsolete or reduced to a short blade but occasionally with a long blade overtopping the compound spike. The European descriptions very generally define the achene as elliptic and of a yellow-gray color. There being no reason in European works for further detail the size is not often given. Holmberg, however, in his very detailed and unfortunately never completed Scandinaviens Flora, Häfte 2: 304 (1926) says "*Nöt* spolformigt [fusiform] elliptick . . 3 mm. läng, 1,5 mm. bred, gul-1. brungrå." The achenes of the European plant (PLATE 763, FIG. 6) range from 3–4.5 mm. long, with the rather definitely elliptic body usually about 3 mm. long and 1.5–2 mm. broad and opaque to barely sublustrous. The achene of the American plant is more definitely fusiform, 4.5–5.5 mm. long, lustrous and of slightly warmer color, the body only 1–1.7 mm. broad, the stipe and beak more prolonged than in the European plant. FIG. 6 shows achenes, × 5, of typical *S. rufus* from Skäne, Sweden, July 14, 1928, *Erik Asplund;* FIG. 7, achenes, × 5, from the TYPE of var. *neogaeus.*

S. SUBTERMINALIS Torr., forma **terrestris** (Paine), comb. nov. Var. *terrestris* Paine, Cat. Pl. Oneida Co., 96 (1865).

S. MARITIMUS L., var. FERNALDI (Bicknell) Beetle, forma **agonus,** culmis ad 1.5 m. altis et 1.3 cm. crassis; foliis ad 15 mm. latis; spiculis 1.2–4 cm. longis; achaeniis late vel subrotundo-obovatis ad basin sensim rotundatis plerumque 2.5–3.2 mm. latis plano-convexis vel lenticularibus dorso sensim rotundatis.—Saline or brackish marshes and fresh tidal shores, Cape Breton, Magdalen Islands, Prince Edward Island and eastern New Brunswick, south to Connecticut. The following belong here. QUEBEC: shallow water near margins of brackish ponds southwest of Étang du Nord village, Grindstone Island, Magdalen Islands, *Fernald, Long & St. John,* no. 6986. PRINCE EDWARD ISLAND: border of salt marsh, Mt. Stewart, *Fernald, Bartram, Long & St. John* no. 6980; salt marsh, Bunbury, *Fernald, Long & St. John,* no. 6987. NOVA SCOTIA: salt marsh at head of Baddeck Bay, Victoria Co., *Fernald & Long,* no. 20,215; edge of brackish marsh, Sable Island, *St. John,* no. 1160; near brackish mouth of Salmon River, Truro, *Fernald & Wiegand,* nos. 4248 and 4249; border of salt marsh, Jordan Falls, Shelburne County, September 4, 1921, *Fernald & Long,* no. 23,398 (TYPE in Gray Herb., distrib. as *S. campestris,* var. *novae-angliae*). NEW BRUNSWICK: brackish marsh, Bathurst Bay, Bathurst, *S. F. Blake,* no. 5457; marsh, Bay du Vin Island, Northumberland County, *Blake,* nos. 5706 and 5707; border of brackish pond,

Photo. B. G. Schubert.

SCIRPUS STEINMETZII, all figs. from type: FIG. 1, inflorescences, × 1; FIG. 2, axis of inflorescence, × 3; FIGS. 3 and 4, spikelets, × 5; FIGS. 5 and 6, achenes, each with single bristle, × 10; FIG. 7, achene viewed from above, × 10.

S. HETEROCHAETUS: FIG. 8. spikelets, × 5; FIG. 9, achene, × 10; FIG. 10, achenes viewed from above, × 10.

Photo. B. G. Schubert.

SCIRPUS EXPANSUS, all figs. from type: FIG. 1, inflorescence, × ⅔; FIG. 2, portion of inflorescence, × 3; FIG. 3, spikelets, with anthers, × 10.

S. SYLVATICUS: FIG. 4, small portion of inflorescence, × 3; FIG. 5, spikelets, with anthers, × 10.

Whale Cove, Grand Manan Island, *C. A. & Una F. Weatherby*, no. 5609. MAINE: salt marsh toward Dennisville, Pembroke, *Fernald*, no. 1414; brackish shores, Pleasant River, Columbia Falls, *Svenson & Fassett*, no. 1005; muddy shore of Herrick's Bay, Flye's Point, Brooklin, *A. F. Hill*, no. 1345; fresh or slightly brackish border of salt marsh, South Thomaston, *Bissell, Fernald & Chamberlain*, no. 8933; wet rocky shore, Matinicus, July 19, 1919, *C. A. E. Long;* sandy salt marsh, Bristol, *E. B. Chamberlain*, no. 695, *Dinsmore & Chamberlain*, no. 839; salt marsh, Bath, August 23, 1911, *Bissell;* Foster's Point, West Bath, 1892, *Kate Furbish;* salt marsh, Hardings', Brunswick, September 13, 1891, *Kate Furbish*, September 27, 1898, *Chamberlain*, no. 936; Kennebunkport, August 7, 1888, *Kennedy;* mouth of York River, York, *Bicknell*, no. 1156, *Fernald & Long*, no. 12,845. NEW HAMPSHIRE: ditch near border of salt marsh, Hampton Falls, August, 1898, *A. A. Eaton*. MASSACHUSETTS: Manchester, *H. D. Thoreau;* salt marsh, West Manchester, *F. T. Hubbard*, no. 73; Somerville, 1882, *C. E. Perkins;* Watertown, July 17, 1880, *C. E. Perkins;* salt marsh, Scituate, September 8, 1901, *W. P. Rich*, September 13, 1914, *C. H. Knowlton;* swale, West Barnstable, *St. John & White*, no. 941. CONNECTICUT: salt marsh, Milford, *E. H. Eames*, no. 39.

Scirpus maritimus, var. *Fernaldi*, forma *agonus*, is the eastern North American plant treated by Beetle in Am. Journ. Bot. xxix. 84, 85 (1942) as typical *S. maritimus* of Europe. It is quite like *S. maritimus*, var. *Fernaldi* (Bicknell) Beetle, l. c. 85, except in having bifid styles and thin plano-convex to lenticular achenes. Throughout the range of var. *Fernaldi*, with trigonous achenes, and its forma *agonus* the two show the same range of variation in spikelets and habit, with a dense glomerule or more commonly with well developed rays, with the latter terminated by single to several and glomerulate spikelets, with the spikelets short and ovoid as in the type of *S. Fernaldi* Bickn. or slender and lance-cylindric, running up to 4 cm. or more long, as in the type of *S. novae-angliae* Britton. Both *S. Fernaldi* and *S. novae-angliae* were based upon specimens with trigonous achenes; and in that series as well as in the one with plano-convex or lenticular and relatively thin achenes there is no line of demarcation evident by which the plants with ovoid and lance-cylindric spikelets can be separated. *S. novae-angliae* was published as a species in 1898, *S. Fernaldi* in 1901. In the varietal rank they are of identical date, published in RHODORA, viii. 163 (1906) as *S.*

campestris, var. *novae-angliae* (Britton) Fern. and var. *Fernaldi* (Bicknell) Bartlett, but since the latter was transferred to *S. maritimus* as var. *Fernaldi* while Beetle considered *S. novae-angliae* to be a variety of *S. robustus* Pursh, *S. robustus*, var. *novae-angliae* (Britton) Beetle, l. c. 87 (1942), they are again of even date. Under these circnustances it seems less disturbing to maintain under *S. maritimus* the first of the two which was treated as a variety of that species.

It is not clear to me why Beetle places *Scirpus novae-angliae* under *S. robustus*. The latter species is a beautifully distinct one of tropical America, following the Atlantic coast northward to Massachusetts, the Pacific to California. Its plump ellipsoid-ovoid to thick-cylindric blunt or bluntish spikelets are rufescent or fulvous, the scales (especially the outer) with very prolonged awns. Its leaf-sheaths have very characteristic orifices, the strong ribs running up the summit to the semicircular or prominently convex dark scarious ligule. *S. novae-angliae*, on the other hand, like European *S. maritimus* and American *S. Fernaldi*, has the ligule V-shaped, with truncate or concave (rarely low-convex) summit and the nerves at the summit of the sheath are slender and relatively inconspicuous. The ovoid to lance-cylindric acute to acuminate spikelets are, as in *S. maritimus*, castaneous to fuscous or blackish, and the awns of the scales are relatively short.

From typical European *Scirpus maritimus*, our var. *Fernaldi* is distinguished merely on size, the leaves running higher on the culm, and upon a slight difference in shape of achene. Our plant is usually taller and coarser, with leaves mostly 6–15 mm. broad (as opposed to the "± 4 (7)"—*Hegi*, of the European); the spikelets of ours are 1.2–4 cm. long ("bis 2 cm. lang" in *S. maritimus*—*Hegi*); and the achenes are generally more broadly obovate and more gradually rounded to the broad base, as opposed to the narrower-obovate achene of *S. maritimus* in which they taper more cuneately or even with a slight concave curve to the slender base.

I do not know how Beetle arrived at the conclusion that true (Eurasian) *Scirpus maritimus* has "Style normally 2-fid" (Beetle, l. c. 87), for the consensus of statements of European taxonomists makes the 2-fid style very exceptional: "*a t y p i c u s*

. . . Narben 3"—*Ascherson & Graebner;* "Stigmates 3 (rar^{t} 2 . . .)"—*Rouy;* "Stigmas 3, or rarely 2"—*Babington;* "Style 3-cleft"—*Bentham;* "Narben 3, seltener 2"—*Hegi.* Although true *S. maritimus* (with 3 stigmas and trigonous achenes) is in Europe the common form, while the so-called var. *digynus* (Simonk.) Godr. is there called rare, with us typical var. *Fernaldi* (with trigonous achenes) and its forma *agonus* are about equally common. At least, in the area from the Gulf of St. Lawrence to Connecticut, where the two somewhat alternate their colonies, the representation before me shows 51 sheets of typical var. *Fernaldi* (including *S. novae-angliae*) and 58 of forma *agonus.* Within this area the two are about equally common; from New York to Virginia the representation before me is all of typical var. *Fernaldi.*

S. PALUDOSUS Nels., var. **atlanticus,** var. nov., a forma typica recedit foliis caulinis plerumque 2–4, sub medio gestis, vaginae venis apice tenuibus vix prominulis; spiculis brunneo-castaneis vel fusco-nigrescentibus; antheris plerumque 2–3.5 mm. longis, filamentis inclusis vel subexsertis; achaeniis rotundo-obovatis vel suborbicularibus rariter cuneatis olivaceis vel atro-brunneis.—Salt marshes and saline shores, Gulf of and lower River St. Lawrence, Quebec, to northern New Jersey; central and western New York. TYPE: salt marsh, Bunbury, Prince Edward Island, August 28, 1912, *Fernald, Long & St. John,* no. 6982 (in Herb. Gray.).

Scirpus paludosus Nels. in Bull. Torr. Bot. Cl. xxvi. 5 (1899), like the identical *S. campestris* Britton in Britt. & Brown, Ill. Fl. i. 267, fig. 626 (1896), not Roth (1795), is the plant of western North America, extending eastward to Manitoba, Minnesota, Nebraska and Missouri. Var. *atlanticus* is the plant of the Atlantic coast, with an isolated and in some ways transitional area in the saline region of interior New York. True *S. paludosus* is a very pale green plant, with culms mostly 0.5–2 cm. thick at base and 0.5–1.5 m. high; the cauline leaves mostly 3–5 (–6), with sheaths ascending well above the middle of the culm (but in starved colonies the culms lower and the leaves fewer and borne chiefly below the middle), their blades mostly 0.5–1.5 cm. broad, the veins near the orifice of the sheath prominent and usually thickened; spikelets whitish-brown to drab or pale brown; anthers 3.5–5 mm. long, standing well out of the spike-

lets on elongate filaments, the filaments, after falling of anthers, usually showing above the scales and twice to thrice the length of the achene; achene cuneate-obovate, rarely roundish, pale brown to olivaceous.

S. paludosus, var. *atlanticus* is not so pale; its culms are 1.5–7.5 dm. high, 2–8 mm. thick at base; the cauline leaves are usually 2–4 and borne chiefly below the middle (though in exceptional plants, perhaps mixed with *S. maritimus*, var. *Fernaldi*, more numerous and running high on the culm), the blades 1.5–9 mm. broad, the veins near summit of sheath delicate and inconspicuous; spikelets chestnut-brown to blackish-fuscous; anthers 2–3.5 mm. long, mostly not exceeding scales, the old filaments rarely exserted and shorter than to about twice the length of the achene; the achene rounded-obovate to suborbicular, only exceptionally cuneate, olivaceous to deep brown. In central and western New York the plant geographically somewhat intermediate between true *S. paludosus* and var. *atlanticus* has the anthers up to 4 mm. long and the achene often cuneate at base. Along the coast of the Gulf of St. Lawrence and of the Atlantic occasional colonies seem like hybrids of *S. paludosus*, var. *atlanticus* and *S. maritimus*, var. *Fernaldi*.

True western *Scirpus paludosus* has an evident tendency to branching of the inflorescence; var. *atlanticus* not. Of the 186 inflorescences of *S. paludosus* before me 124 have simple or at least closely crowded glomerules, 62 (33%) have 1 or 2 (rarely 3 or 4) obvious elongate rays. Of 420 inflorescences of var. *atlanticus* only 20 (less than 4%) show a single (in 1 case 2) short ray. On the Atlantic coast the plant with fuscous spikelets frequently on definite or elongate rays is *S. maritimus*, var. *Fernaldi*. Of the 210 inflorescences of it before me 172 (nearly 82%) have definite (sometimes forking) rays (26 with 1 ray, 77 with 2, 28 with 3, 20 with 4, 13 with 5, 13 with 6, 6 with 7, 5 with 8, 1 with 11, 1 with 12 and 4 with 13).

Although Beetle in Am. Journ. Bot. xxix. 83 (1942) cites *Scirpus paludosus* as occurring in the "EAST INDIES: *Ekman 1325*" (this citation placed between New Jersey and Minnesota), there is grave doubt about it. I have not seen no. 1325 and can, consequently, not check its identity; at least, it presumably came from the *West* Indies.

S. expansus, sp. nov. (TAB. 767, FIG. 1–3), planta habitu *S. sylvatici;* culmo 0.5–1.6 m. alto ad basin 0.6–1.5 cm. crasso superne scabro; foliis 1–2.5 cm. latis, vaginis coriaceis valde septato-nodulosis; involucri foliis 3–8, imis panicula superantibus; panicula 1–3 dm. alta radiis adscendentibus vel divaricatis; pedicellis valde pilosis; spiculis 3–5 mm. longis, plerumque glomerulatis; squamis valde carinatis apice subulatis; antheris 1.3–1.6 mm. longis.—Spring-heads, borders of rills, springy meadows, swales, etc., southwestern Maine to southern Michigan, south to Georgia. The following, selected from a large series, are representative. MAINE: South Poland, 1895, *Kate Furbish; Typha* swamp, bank, Presumpscot River, August 13, 1903, *Collins & Chamberlain,* no. 614 (TYPE in Herb. Gray.); springy spot, Great Chebeague Island, *Fernald,* no. 1401; swale at border of salt marsh, Wells, *Fernald & Long*, no. 12,851; swamp, York Harbor, July 22, 1901, *F. T. Hubbard.* NEW HAMPSHIRE: Hanover, August, 1878, *Jesup;* Ore Hill, Warren, July 26, 1910, *E. F. Williams;* shore of Johnson Creek, Madbury, *Hodgdon*, no. 2629. VERMONT: Gulf Brook swamp, Townshend, September 10, 1912, *L. A. Wheeler.* MASSACHUSETTS: south end of Horn Pond, Woburn, August 4, 1869, *Wm. Boott;* South Sudbury, June 17, 1902, *Rich, Fernald & Williams;* Westfield, July 10, 1860, *Wm. Boott;* brook in cold bog, Shirley, August 27, 1916, *Churchill;* brooksides, Uxbridge, June 23, 1876, *Morong;* shore of small pond, Granville, *F. C. Seymour*, no. 388; New Salem, July 28, 1931, *Goodale, Potshay & St. John;* brookside, New Marlboro, August 30, 1902, *Ralph Hoffmann.* CONNECTICUT: West Hartford, July 13, 1901, *H. J. Koehler;* swamp, Southington, *Bissell*, no. 722; New Hartford, August 10, 1883, *Chas. Wright;* along Steele Brook, Waterbury, *Blewitt*, no. 456; open swamp, Milford, *E. H. Eames*, no. 4000. NEW YORK: wet ditch, Fort Anne, Washington County, *Burnham*, no. 46; along a cold stream, 4 miles south of Utica, *Haberer*, no. 1184; Waterville, Oneida County, August 18, 1917, *House.* NEW JERSEY: Rosenkraus Run, Sussex County, August 11, 1917, *E. B. Bartram.* PENNSYLVANIA: open marshy, springy swale, Lehigh Gap Station, *Pretz,* no. 13,253; roadside ditch, 2 miles north of Sadsburyville, Chester County, June 29, 1924, *H. E. Stone;* Big Meadow Run, Farmington, Fayette County, June 4, 1931, *Core.* DELAWARE: along brooks, Centreville, August, 1869, *Commons.* DISTRICT OF COLUMBIA: Washington, 1881 ("the most southern locality known"), *Scribner.* VIRGINIA: South Fork of Holston River, St. Clair's Bottom, Smyth County, July 30, 1892, *Small.* NORTH CAROLINA: near Hickory, Catawba County, *Heller*, no. 274. GEORGIA: in cool shaded brook at northern base of Stone Mountain, *Harper*, no. 205. MICHIGAN: swamp, Grand Rapids, July 20, 1900, *Emma J. Cole.*

Scirpus expansus is the plant which regularly passes in the eastern United States as *S. sylvaticus* L. of Eurasia. The resemblance is merely superficial, for in most characters there are clear distinctions. *S. sylvaticus* has thinner leaves, with scarious sheaths, the summit of the inner band easily friable, the blades 6–14 mm. wide; in *S. expansus* the hard and thickish blades are 1–2.5 cm. broad, the coriaceous sheaths strongly septate-nodulose (in *S. sylvaticus* only faintly, if at all, so), the summit of the inner band firmer. In *S. sylvaticus* the relatively slender culm is smooth to summit; in *S. expansus* the usually coarser culm is scabrous at summit (for 1–5 cm.). In *S. sylvaticus* the longest smooth and thin leaf of the involucre is 0.7–2 dm. long, only rarely exceeding the panicle; in *S. expansus* it is firm and harshly scabrous beneath and 1.5–3 dm. long, often overtopping the panicle. In *S. sylvaticus* the mature panicle is lax, with loosely spreading to recurving longer rays, the panicle 1–2 dm. high; in *S. expansus* the longer rays (FIG. 4) are more stiffly ascending to divergent, only the short basal ones much recurving, and the panicle, when well developed, is 1.5–3 dm. high. In *S. sylvaticus* the spikelets (FIGS. 4 and 5) are 3–4 mm. long and in glomerules of 2–5, the ultimate lateral pedicels often terminated by single spikelets; in *S. expansus* the principal glomerules have 3–12 (rarely to 40) spikelets 3–5 mm. long, only a rare ultimate pedicel with a solitary one. In *S. sylvaticus* the pedicels are minutely scabridulous; in *S. expansus* closely pilose. In *S. sylvaticus* the scales of the spikelet (FIG. 5) are blunt or barely mucronate by the extension of the relatively weak midrib; in *S. expansus* they (FIG. 3) have subulate-acuminate tips, through the extension of the very prominent keel-like midrib. In *S. sylvaticus* the anthers (FIG. 5) are 0.7–1 mm. long; in *S. expansus* (FIG. 3) 1.3–1.6 mm. long.

Forma **Bissellii** (Fernald), comb. nov. *S. sylvaticus*, var. *Bissellii* Fernald in RHODORA, ii. 21 (1905); *S. microcarpus*, var. *Bissellii* (Fern.) House in Bull. N. Y. State Mus. nos. 243–244: 18 (1923). *S. sylvaticus*, forma *Bissellii* (Fern.) Carpenter in Dole, Fl. Vt. ed. 3: 76 (1937).

Forma **globulosus,** f. nov., glomerulis globosis 7–12 mm. diametro, spiculis 20–60 congestis valde imbricatis 3–4 mm. longis.—NEW YORK: Lyon's Falls, Lewis County, August, 1882, *J. V. Haberer* (TYPE in Herb. Gray.).

A very unusual extreme, the inflorescence, with large globose heads of very numerous spikelets superficially suggesting the most extreme *Juncus canadensis* J. Gay. Not to be confused with forma *Bissellii*. That has the large glomerules 1–2 cm. in diameter and composed of loosely divergent linear-cylindric spikelets 6–14 mm. long.

Since some botanists place *Scirpus expansus* under the western North American *S. microcarpus* Presl, it is well to point out that *S. microcarpus* has 2 stigmas and lenticular achenes; *S. expansus* 3 stigmas and trigonous achenes. In *S. microcarpus* the smooth or nearly smooth leaf-sheaths and the leaf-blades are thinner and smoother than in *S. expansus*, the involucre only slightly if at all exceeding the inflorescence; as contrasted with the heavier and septate-nodulose sheaths of *S. expansus*, the broader and firmer blades scabrous beneath and the usually longer involucres. In its thin and relatively narrow leaves with smooth or nearly smooth sheaths *S. microcarpus* is more like *S. sylvaticus* of Eurasia. In the texture of its scales and the size of its panicle (0.8–2 dm., only exceptionally—3 dm. high) it is more like the latter, but the glomerules have many more and usually longer spikelets. Unless all members of the section are to be reduced to an all-inclusive *S. sylvaticus*, with several constant and geographically isolated subdivisions, some with 2 stigmas, others with 3, these fundamental characters of the pistil associated with other characters, the three North American members of the series, *S. microcarpus* Presl, *S. rubrotinctus* Fern. and *S. expansus* are well marked species.

In PLATE 767, FIGS. 1–3 are of SCIRPUS EXPANSUS, from the TYPE: FIG. 1, inflorescence, × ⅖; FIG. 2, portion of inflorescence, to show characteristic ascending branches with spikelets mostly glomerulate, × 3; FIG. 3, spikelet with anthers, × 10. FIGS. 4 and 5, S. SYLVATICUS from Tassin, France, *Boulin:* FIG. 4, small portion of inflorescence to show characteristic divergent branching, with lateral spikelets often solitary, × 3; FIG. 5, spikelets with anthers, × 10.

S. RUBROTINCTUS Fern., forma **radiosus,** f. nov., spiculis lineari-cylindricis 7–13 mm. longis in glomerulis radiosis 1.5–2.3 cm. diametro aggregatis.—MAINE: tidal swales along Cathance River, Bowdoinham, September 14 and 19, 1926, *Fernald & Long*, nos. 12,853 (TYPE in Herb. Gray.), 12,854; ditch near wharf, Camden, August 11, 1902, *G. G. Kennedy.*

The counterpart in *Scirpus rubrotinctus* of *S. expansus*, forma *Bissellii.*

S. ATROVIRENS Muhl., var. GEORGIANUS (Harper) Fern., forma **cephalanthus,** f. nov., glomerulis dense confertis in capitulo 1.3–5 cm. diametro aggregatis. TYPE: river-thicket, Veazie, Maine, August 25, 1908, *Fernald* (in Herb. Gray.).

S. ATROVIRENS Muhl., var. GEORGIANUS (Harper) Fern., forma **angustispicatus,** f. nov., spiculis anguste cylindricis ad 1 cm. longis. TYPE: wet shore of Housatonic River, Newtown, Connecticut, August 17, 1928, *E. H. Eames,* no. 10,692 (in Herb. Gray.).

S. POLYPHYLLUS Vahl, forma **macrostachys** (Boeckl.), comb. nov. Var. *macrostachys* Boeckl. in Linnaea, xxxvi. 731 (1870).

VI. THE IDENTITY OF SCLERIA SETACEA OF POIRET

One of the most definite and easily recognized species of *Scleria* is the handsome and tall cespitose but lax plant with soft and almost wing-angled easily compressed culms up to 1 m. high; broad, lax leaves up to 8 mm. wide; long, drooping, filiform, lateral peduncles and loosely fastigiate terminal panicles up to 4 cm. long; the globose and reticulate achenes with spirally arranged pits and pubescent surfaces, the hypogynium with 3 broad erect lobes. This relatively tall species occurs from warm-temperate eastern South America, the West Indies and Florida to eastern Texas and Mexico, north in the Atlantic States to Long Island, and locally in the interior to Indiana.

This is the handsome plant beautifully described as *S. laxa* by Torrey in Ann. Lyc. N. Y. iii. 376 (1836), Torrey's appropriate name unfortunately preempted by the Australian *S. laxa* R. Br. (1810). Somewhat earlier Muhlenberg had described the same plant from North Carolina as *S. reticularis* Muhl. Descr. Gram. 266 (1817), he mistaking it for *S. reticularis* Michx. (1803). This confusion was soon noted, however, and there resulted two names: *S. Muhlenbergii* Steud. Nom. ed. 2, ii. 543 (1841), based upon "S. laxa. *Torr.* (non *R. Br.*) S. reticularis *Mhlbrg. Pursh.* (non *Michx.*)"; and, a little later, *S. Torreyana* Walp. Ann. iii. 696 (1852), based on *S. laxa* Torr. Other but later names were given to the plant; *S. Muhlenbergii* Steud., however, being the earliest available one, we may in this note omit the others, especially since their exact identification is not now possible. For this tall plant with compressed-trigonous culms, broad and

flat leaves and terminal lax panicles up to 4 cm. high Core, in his *American Species of Scleria* in Brittonia, ii. 79 (1936), takes up *S. setacea* Poir. in Lam. Encyc. vii. 4 (1806); and others, as unwittingly as myself, have trustingly followed him.

The photograph of the type of *S. setacea* Poir., however, thoroughly agrees with the original description:

8. SCLÉRIE à feuilles sétacées. *Scleria setacea.*

Scleria culmo foliisque setaceis, glaberrimis; spicis axillaribus, minimis, longè pedunculatis; spiculis angustis, pedicellatis seu subsessilibus (N.)

Ses racines sont courtes, fibreuses, fasciculées: il s'en élève des tiges nombreuses . . . , haute de huit à dix pouces & plus, très-grêles, fines, sétacées, triangulaires . . .

De l'orifice de chaque gaîne, même à partir de celles du bas, il sort un pédoncule droit, très-fin, long d'un pouce & plus, terminé par deux, trois, à peine quatre épillets pédicellés, quelquefois un ou deux sessiles, petites, étroits, ovales-oblongs, aigues, d'un roux-clair, munis de petites bractées courtes, sétacées, a peu près de la longeur de l'épillet.

Cette plante croît dans l'Amérique; elle e été recueillie par M. Ledru à Porto-Ricco (*V. s. in herb. Lam.*)

It is most difficult to imagine how *Scleria Muhlenbergii* could ever have been identified with *S. setacea*, described as having setaceous culms up to 10 inches high, setaceous leaves, small red spikes, etc., the photograph before me showing the terminal inflorescence to be compact and 6–8 mm. high. Search in West Indian *Scleria* shows nothing like it, *S. Brittonii* Core and *S. georgiana* Core both having elongate horizontal rhizomes and larger terminal inflorescences; but the slender and acuminate reddish spikelets and the dense non-rhizomatous base at once suggest *Rhynchospora.* Turning to that genus, the type of *Scleria setacea* Poir. is promptly matched, even to the short-peduncled inflorescences in the lower leaf-axils, by R. SETACEA (Berg.) Boeckl., based upon *Schoenus setaceus* Bergius (1772). The fact that Poiret, in 1806, used the same specific name was merely coincidence; but the fact that his *Scleria setacea* coincides with *Schoenus setaceus*, therefore with *Rhynchospora setacea*, removes that wholly misinterpreted name from the valid species of *Scleria.* The many North American, West Indian and South American specimens recently marked "*Scleria setacea* Poir.", should be changed to S. MUHLENBERGII Steud.

VII. WHAT IS ANGELICA TRIQUINATA?

(Plates 768 and 769)

In his Flora Boreali-Americana, i. 167 (1803) Michaux described from "Canada" a single species of *Angelica* as

> TRIQUINATA. A. petiolo tripartito; partitionibus pinnato-quinquefoliolatis; foliolis inciso-dentatis; terminalium impari rhombeo, sessili, lateralibus decursivis.
> *Obs.* Glabra: pedunculo pedicellisque minutissima pube subcandicantibus.
> *Hab.* in Canada.

Pursh (1814) took it up, literally copying Michaux's diagnosis but giving the range "In Canada and on the mountains of Virginia", from which it is probable that Pursh was stretching the name to cover the later published *Angelica Curtisii* Buckl.; and others, Bigelow, Fl. Bost. (1814) for instance, accepted it for the common New England *A. atropurpurea* L.

In 1818 three different authors independently considered *Angelica triquinata* to be the plant of dry woods and thickets southward, with stem closely tomentulose above, with thick lanceolate to oblong regularly and closely serrate leaflets, the upper or bracteal leaves (subtending inflorescences) reduced to linear-cylindric or lanceolate tubular sheaths with tiny blades, the plant which Walter, Fl. Carol. 115 (1788) had well described as *Ferula villosa*, i. e. *Angelica villosa* (Walt.) BSP. Muhlenberg, Cat. ed. 2: 30 (1818), substituted for *A. triquinata* Michx. his own *A. hirsuta*, saying without quibble ANGÉLICA . . . "1 hirsuta, *triquinata*, Mx." and giving the single descriptive word, "downy", Muhlenberg's plant coming from "Pens. fl. Aug. N. Eb." At best *A. hirsuta* Muhl. is a nomen subnudum; but since he used the name as a substitute[1] for *A. triquinata* Michx. (1803) it is illegitimate. Nuttall, also in 1818, took up *A. triquinata*, obviously for *Ferula villosa* Walt. His description of the plant "Common around Philadelphia" was good, except for the phrase, "Leaves sharply and incisely serrate", evidently borrowed from Michaux; and, obviously not understanding Michaux's plant, he commented on the plant of "Canada to

[1] In his Cat. ed. 1: 31 (1813) Muhlenberg had published the trinomial *Angelica hirsuta triquinata* as a "downy" plant of "Pens." It was in the 2nd edition (1818) that he cited *A. triquinata* Michx. as a synonym of his *A. hirsuta*.

Carolina" as "Certainly a genuine species". In the same year Sprengel, Species Umbelliferarum minus cognitae, 69, t. vi. fig. 12 (1818), based his *Pastinaca triquinata* upon *Angelica triquinata* Michx., "Habitat in Canada et Virginia" (borrowed from Pursh), and gave a fine description and excellent illustration of *Ferula villosa* Walt., changing the "Foliolis inciso-dentatis; terminalium impari rhombeo, sessili" etc. of Michaux (impossible for *Ferula villosa*) to "foliolis oblongis" of *F. villosa*, and noting the reduced upper blades and sheath-like petioles of the latter, "Superiora minus divisa vaginis petiolaribus insidentia".

Many authors followed these false leads and the name *Angelica triquinata* Michx. became general, as the first supposedly available combination under *Angelica* (following the sensible, therefore abandoned, "Kew Rule") for *Ferula villosa* Walt.; not merely Nuttall and Sprengel so using it, but Elliott, Torrey, DeCandolle and others accepting the identification. When Sprengel took it up as the basis of *Pastinaca triquinata* (Michx.) Spreng. he did so in a work on Umbelliferae "minus cognitae", and his phrase very definitely described his understanding of Michaux's plant. When he first studied Michaux's herbarium Asa Gray saw the error, his memorandum reading "Not the least what we call *A. triquinata*. DC. has confounded strangely if he ever saw Michx's. plant . . . It is *A. atropurpurea*?—tho' very poor specimen".

Gray's guess is hardly better than that of his predecessors, for even his "tho' very poor specimen" does not endow the Michaux plant with the characters of *A. atropurpurea*. In the latter the upper leaves, which subtend inflorescences, have large, inflated and round-tipped stipular sheaths extending quite to the summit of the obscure petiole, so that the 3 divisions of the leaf are essentially sessile, and the leaflets are not incised-dentate. Furthermore, the subspherical umbel has 20–46 rays. In 1903 I made a photograph of the Michaux TYPE at Paris. This (PLATE 768) shows, × ½, the incised-dentate leaflets, the terminal unequally rhombic, the lateral decurrent, as described by Michaux. It also shows the stipular sheath narrow and tapering to the elongate and naked upper half of the petiole; and the axillary branch has one slender and tubular bladeless sheath and an immature umbel with only 7 ascending rays. I have been over, with Dr. Hugh M. Raup, all known eastern North

American *Umbelliferae*. Every one of them is quickly rejected as not Michaux's plant, except the Alleghenian *A. Curtisii* Buckley, Am. Journ. Sci. xlv. 173 (1843) which follows the upland and the mountains from Pennsylvania to Georgia. Buckley's species gives a good match for *A. triquinata*, a more modern specimen from the Blue Ridge of Virginia (near Luray, alt. 3600 ft., *Steele & Steele*, no. 213), reproduced as PLATE 769, showing a portion of a plant, × ½, with the tapering sheath (at base), the elongate petiole (near base), the incised leaflets, the terminal one rhombic, the lateral (upper) ones decurrent and the few-rayed umbel of the Michaux type. Buckley's plant, from "High mountains of North Carolina" had "petioles large, long, and sheathed at the base; segments of the leaves 3–5, leaflets large and deeply laciniate". It is evident that "Canada" of Michaux's label and description was a clerical error for CAROLINA, Michaux having collected extensively in the Carolina mountains. It is clear, then, that the name *Angelica Curtisii* Buckley (1843) must give way to A. TRIQUINATA Michx. (1803).

Another reason for thus reviewing the interpretations of *Angelica triquinata* is the fact that the name *A. villosa* (Walt.) BSP. Prelim. Cat. N. Y. 22 (1888) is a later homonym, invalidated by the fully described *A. villosa* Lagasca, Gen. et Sp. Pl. 12 (1816), a plant of Asturia. Since, furthermore, *A. hirsuta* Muhl. was an illegitimate substitute for *A. triquinata* Michx., the name *hirsuta* used very carelessly for a plant which is not hirsute but said to be "downy" (many a youth with downy face has anxiously waited for it to become hirsute), the name *A. triquinata*, long used for *A. villosa*, seemed to come into the running. That it cannot be taken up for *A. villosa* (Walt.) BSP. should be sufficiently clear.

Only one other name is sometimes cited as synonymous with *Angelica villosa* (Walt.) BSP. This is *Cicuta venenosa* Greenway in Trans. Am. Phil. Soc. iii. 235 (1793), incorrectly cited by Pursh as *C. venenata* in his synonymy of *Ferula villosa*. Greenway, not now a well known botanist, was "*Dr. James Greenway, of Dinwiddie-County, in Virginia.*" His account of the plant as an acute poison when eaten and his very detailed description are conclusive. It is unnecessary to quote the whole, but Dr. Greenway's solicitude for the Philosophical Society, to whom he

Photo. M. L. Fernald.

Type of Angelica triquinata Michx., × ½.

Photo. B. G. Schubert.

ANGELICA TRIQUINATA Michx: portion of plant, × ½, of *A. Curtisii* Buckley.

communicated his paper on February 19, 1790, is worth quoting: "I will here insert the description, as it stands in my catalogue, first, in botanical terms, for such as are lovers of that science, and then in language, as plainly English as the subject will admit, for the sake of those to whom those terms are less familiar." The detailed description, with "Caulis . . . quatuor pedes altus, teres, . . . superne tomentosus.—Folia petiolata, petiolis semi-amplexicaulibus, . . . triternata, bipinnata, . . . foliolis sessilibus, oblongo-lanceolatis, serratis", and the habitat and flowering season (in Dinwiddie County), "Locis campestribus et collibus apricis gaudet: mensibus Julii Augustique floret", are wholly indicative of *A. villosa*. The latter should, therefore, be called:

ANGELICA **venenosa** (Greenway), comb. nov. *Cicuta venenosa* Greenway in Trans. Am. Phil. Soc. iii. 335 (1793). *Ferula villosa* Walt. Fl. Carol. 115 (1788). *A. triquinata* sensu Nutt. Gen. i. 186 (1818) and later authors, not Michx. (1803). *Pastinaca triquinata* Spreng. Spec. Umb. 69, t. vi. fig. 12 (1818) as to plant described and illustrated, not as to source of epithet, *A. triquinata* Michx. *Archangelica hirsuta* Torr. & Gr. Fl. N. Am. i. 622 (1840) as to plant described, only in part upon source of epithet, *Angelica hirsuta* Muhl. Cat. ed. 2: 30 (1818), an illegitimate substitute (as treated by Muhlenberg) for the early *A. triquinata* Michx. (1803). *A. villosa* (Walt.) BSP. Prelim. Cat. N. Y. 22 (1888) by inference only, not *A. villosa* Lagasca, Gen. et Sp. Pl. 12 (1816).

MEMORANDUM REGARDING JAMES GREENWAY.—I am indebted to Mr. J. M. Townsend of Petersburg, Virginia, for a reference to Castiglioni's Reise durch die Vereinigten Staaten von Nord-Amerika in den Jahren 1785, 1786 and 1787. On p. 274 of this German translation we read:

"Eine Meile von Petersburg liegt die Wohnung des Obristen **Banister,** der eine ausgedehnte Pflanzung besitzt. Er is ein Enkel des berühmten **John Banister,** der seine Stelle als Professor der Botanik und Bibliothekar der Universität Oxford niederlegte, und sich in diesem Thiele von Virginien niederliess, wo er mit grosser Mühe und seltenem Urtheil eine Menge der seltensten Pflanzen sammelte, und beschrieb. . . Am folgenden Tage stattete ich einen Besuch beym **D. Greenway** ab, der ein Engländer von Geburt, und ein Liebhaber der Botanik ist. Er hatte sich selbst mit den Grundsätzen des Linneischen Systems be-

kannt gemacht, und wusste mehr als 600 Pflanzen zu nennen, unter denen einige ziemlich seltene und noch unbeschriebene waren."

Mr. Townsend also most kindly transcribes for me extracts about Dr. James Greenway from the recently (1942) published Dinwiddie County "The Country of the Apamatica", compiled by the workers of the Writer's Program of the Works Projects Administration. From this account (p. 77) I quote: "It was after he had established himself in Dinwiddie as a man of wealth and importance—somewhat Scottish as he was—that he turned his whole attention to natural history and botany. Some 40 volumes that deal with plants of Virginia and North Carolina flowed from his pen and won him honorary membership in several European societies and friendships with scholars the world over. Thomas Jefferson, that great patron of learning, frequently corresponded with Dr. Greenway and gave consistent encouragement to the botanical investigations of the Dinwiddie scientist."

I have hunted in vain, with the collaboration of Dr. Schubert, for the "40 volumes that deal with plants". Pritzel (Thesaurus) did not know of them. Dryander, Cat. Bibl. Hist.-Nat. Banks, iii. 542 and 598 (1797) and the Royal Society Catalogue, iii. 5 (1869) could muster only the two short papers in vol. iii. of the American Philosophical Society's Transactions (1793), the first on *Cassia Chamaecrista* as a soil-renovator, the second the account of *Cicuta venenosa*. If, contemporary with Thomas Walter (1788) and prior to Michaux (1803), Pursh (1814) and Elliott (1816 et seq.), there were two score volumes published, describing in such clear diagnoses as that of *Cicuta venenosa* 600 plants of Virginia and North Carolina, their discovery would be of utmost importance and extremely disconcerting.

Through the most helpful cooperation of Messrs. Jack Dalton of the Alderman Library at the University of Virginia and R. W. Church of the Virginia State Library the excitement among taxonomists over the "40 volumes that deal with plants of Virginia and North Carolina [which] flowed from his [Greenway's] pen" is now abated. Under date of November 21, 1942, Mr. Dalton wrote: "The reference . . . puzzles us as much as it does you. I have examined our catalogues, the calendars of

Jefferson's Correspondence, the bibliographies, English and American, available here, and *Swem's Index*, and have not been able to find the slightest evidence of the existence of the forty volumes or the voluminous correspondence of Jefferson. Dr. Greenway's name is not mentioned in our calendar of Jefferson's correspondence". Mr. Church, examining the notes made by the Virginia Writer's Project in connection with their history of Dinwiddie County, found that the statement concerning the forty volumes was derived from the Memoirs of Lieutenant General Winfield Scott, vol. 1, pp. 3–6 of the edition of 1864. Here is the quotation as filed by the authors of the history of Dinwiddie County:

"His professional reputation brought him patients from a wide circumference, but, as he became rich, he gradually withdrew from the practice of medicine, and gave himself up to the culture of polite literature and natural history, particularly botany, and left a *hortus siccus* of some forty folio volumes in which all the more interesting plants, etc., of Virginia and North Carolina, were described in classical English and Latin."

A *hortus siccus* being a collection of dried plants (an herbarium) it is evident that the presumably very accurate descriptions of Greenway which "flowed from his pen" did not reach publication.

In publishing the genus GREENWAYA Giseke, Praelect. Ord. Nat. Plant. 226 (1792), wrote: "in honorem Cl. . . . GREENWAY, Med. Dris. in Virginia, cujus amicitiam & cum eo commercium debui epistolarum Cl. Drury, inter Entomologos celebri. Misit ille ab a. 1773–1775. plantas Virginicas siccatas, vivas a se collectas, ad 400. eo fine ad me, ut novam Floram Virginicam juncto labore concinnaremus, sed bello inter Anglos & colonias orto, conatus omnis profligatus est, ita ut nesciam num vivus adhuc supersit nec-ne? Eo tamen labore utique de Botanica meritus est".

(To be continued)

OUR VARIETIES OF BARBAREA VULGARIS.—The introduced and naturalized *Barbarea vulgaris* R. Br. occurs with us as four well defined varieties. These I am distinguishing as follows:

Pedicels ascending to appressed or erect; siliques erect or strongly ascending, closely overlapping, the raceme dense.
Siliques (excluding beak) 1.5–3 cm. long.....*B. vulgaris* (typical).
Siliques (excluding beak) 0.8–1.5 cm. long.....Var. *sylvestris*.
Pedicels spreading; siliques arcuate-ascending to horizontally divergent, not imbricated, the raceme lax and open.
Siliques (excluding beak) mostly 2–3 cm. long.....Var. *arcuata*.
Siliques (excluding beak) mostly 0.7–1.5 cm. long.....Var. *brachycarpa*.

Typical *Barbarea vulgaris* is the introduced plant misidentified as *B. stricta* in Gray, Man. ed. 7. It is wide-ranging in eastern America. Var. *arcuata* (J. & C. Presl) Fries is the plant called in Gray, Man. ed. 7 typical *B. vulgaris*. It is also of wide range with us. Ordinarily var. *arcuata* is quite glabrous. A form of it with basal leaves, including petioles, copiously villous-hirsute has been found in Maine and New York. This is

BARBAREA VULGARIS R. Br., var ARCUATA (J. & C. Presl) Fries, forma **hirsuta** (Weihe), stat. nov. *B. hirsuta* Weihe in Flora, xiii. 257 (1830). *B. vulgaris*, β. *bracteata*, sub-var. *hirsuta* (Weihe) Rouy & Foucaud, Fl. Fr. i. 198 (1893). *B. vulgaris*, var. *hirsuta* (Weihe) Fernald in RHODORA, xi. 139 (1909). *B. vulgaris*, subsp. *euvulgaris*, subforma *hirsuta* (Weihe) Hayek, Prod. Fl. Pen. Balc. i. 386 (1927).

The other two varieties are more local. Var. *sylvestris* Fries I have seen only from Anticosti Island, QUEBEC: along railroad, 25 miles inland, August 22, 1917, *Victorin*, no. 4364 (identified by me as var. *brachycarpa*), and from WASHINGTON: Seattle, July 1, 1889, *Piper*, no. 754. Var. *brachycarpa* is before me from various stations in Quebec, New Hampshire, Massachusetts and Connecticut. A double-flowered form, apparently of var. *arcuata* (the fruit not forming) has been found in Quebec. This is

B. VULGARIS, var. ARCUATA, forma **plena,** f. nov., petalis numerosissimis, staminibus petaloideis. QUEBEC: by brook, Wolfe Cove, August 6, 1902, *Williams & Fernald* (TYPE in Herb. Gray.).—M. L. FERNALD.

Volume 45, no. 534, including pages 217–264 and plates 749–761, was issued 29 May, 1943.

AUG 13 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. August, 1943. No. 536.

CONTENTS:

Botanical Collections of the Wood Yukon Expedition of 1939–1941. *Anderson Bakewell.* 305

Contributions from the Gray Herbarium of Harvard University—No. CXLVIII. *M. L. Fernald.*
VIII. Notes on Hieracium. 317

The Wild Cherry of the Carrizo Sands of Texas. *V. L. Cory.* 325

New Amsonia from the Ozarks of Arkansas. *Robert E. Woodson, Jr.* 328

Potamogeton Spirillus may grow as an Annual. *W. C. Muenscher.* 329

Our Varieties of Trifolium pratense. *M. L. Fernald.* 331

Trifolium hybridum and its Var. elegans. *M. L. Fernald.* 331

Centaurea nervosa in America. *M. L. Fernald.* 331

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. **August, 1943.** **No. 536.**

BOTANICAL COLLECTIONS OF THE WOOD YUKON EXPEDITIONS OF 1939–1941

ANDERSON BAKEWELL

DURING the period of 1935–1941 four expeditions under the leadership of Mr. Walter A. Wood, of the American Geographical Society of New York, have entered the St. Elias Range in the Yukon Territory, Canada. These expeditions, sponsored by the Geographical Society, have had as their objective the carrying out of a program of aerial surveying and mapping of the range, centering around the area drained by Wolf Creek Glacier.

In addition to the surveying and mapping, meteorological observations were conducted during all expeditions,[1] geological investigations were made in 1941 and a program of active mountaineering was carried out. Mt. Steele (16,644 ft.) was climbed in 1935[2] and Mt. Equinox (9,970 ft.) in 1936. In 1939 an attempt on Mt. Wood (15,880 ft.) failed due to the prevalence of bad weather[3]. This, together with Mt. Walsh (14,780 ft.), was successfully ascended in the summer of 1941[4].

It was the good fortune of the author to accompany the 1939 and 1941 expeditions, during which botanical collections were made. The writer makes no pretence of being a botanist, nor

[1] The accumulated field data are on file at the American Geographical Society.

[2] W. A. Wood: The Wood Yukon Expedition of 1935: An Experiment in Photographic Mapping, Geographical Review, Vol. **26**, 1936, pp. 228–246. American Alpine Journal 1936.

[3] American Alpine Journal 1940: An Attempt on Mt. Wood, St. Elias Range, by Foresta Hodgson Wood.

[4] W. A. Wood: The Parachuting of Expedition Supplies: An Experiment by the Wood Yukon Expedition of 1941, Geographical Review, Vol. **32**, 1942, pp. 36–45. American Alpine Journal 1942.

even of being familiar with botanical language. Because of the remoteness of the region, however, and its relative inaccessibility, it was thought that such specimens as might be brought out would be of interest. Dr. Hugh M. Raup, of the Arnold Arboretum, Harvard University, was kind enough to place his time and valuable advice at the disposal of the expedition and to identify the specimens brought in.

Entrance to the region is effected from Skagway, Alaska, by way of the White Pass and Yukon Railway to Whitehorse, Yukon Territory. Thence alternate routes are by road or plane to Burwash Landing on Kluane Lake, 150 miles northwest of Whitehorse. From the Landing it is a four-day pack trip by horse to the snout of Wolf Creek Glacier (ca. 3700 ft.).[1]

Between Kluane Lake and the Donjek river the route crosses the tundra to the north of Wade Creek. The Donjek may be crossed with horses, which then proceed up the bank of Wolf Creek and along the south lateral moraine of the Wolf Creek Glacier.

At this latitude (61° N) timber line is reached between 4000 and 4500 feet. As the base camps of both years were at 5500 feet, the greater portion of the collecting was done above timber line, except for specimens collected en route early in the summer and on the return in the fall.

Collecting in general was done in the tundra and alpine meadows, along streams and the margins of glacial lakes, on rock slides and up to the limit of vegetation on the surrounding peaks.

The work was spread out over the summer and often interrupted for several weeks at a time by prolonged trips on the glaciers and high peaks. Because of these interruptions, and the fact that the collecting had often to cover large areas over short periods of time, no claim is made to its being complete nor representative of all the species in the region. As is usual in the case of a novice collector, the large and outstanding plants were collected first. For photographs and a description of the region the reader is referred to Mr. Wood's article in the 1936 issue of the Geographical Review.[2]

[1] See map, Geographical Review, Vol. 32, 1942, p. 37.
[2] W. A. Wood: Op. cit. page 1.

The writer wishes to express his indebtedness to Mr. Wood for making the work possible, to Mrs. Wood and members of the expeditions for their valuable help and contributions, to Dr. Robert Sharp, geologist of the 1941 Expedition, for his collection of willows, and to Dr. Raup for his assistance in the identification of specimens and the preparation of this report.

Description of Localities

1939

Nos. 1–34, incl. *Burwash Landing* (Lat. 61° 25′ N., Long. 139° W.). Small settlement situated near the north end of Kluane L. at an altitude of 2500′ (ca.). Collecting was done in the surrounding meadows, forests and burned-over areas. July 8–20.

Nos. 35–38, incl. *Base Camp, 1939* (Lat. 61° 15′ N., Long. 140° 9′ W.). Situated beside the lateral moraine on the true right side of Wolf Creek Glacier near its bend, alt. 5500′. Collections are from the moraine, along streams, from rock slides and open areas. July 20–27.

Nos. 39–81, incl. *Advance Base Camp, 1939* (Lat. 61° 15′ N., Long. 140° 12′ W.). On true right bank of Wolf Creek above its juncture with Wolf Creek Glacier, alt. 5700′. Collections from rock slides and tundra. July 27–Aug. 27.

1941

Nos. 82–110, incl. *Between Burwash Landing and Summit Camp*, alt. 2500–4000′ (for description of route see above). June 22.

Nos. 111–114, incl. *Mouth of Wolf Creek* (Lat. 61° 20′ N., Long. 139° 50′ W.), alt. 3200′. June 25.

Nos. 115–164, incl. *Base Camp, 1941* (Lat. 61° 16′ N., Long. 140° 12′ W.). Located on the true left bank of Wolf Creek above its juncture with Wolf Creek Glacier. Collections are from rock slides, tundra, around small glacial lakes, and up to 9000′ in the mountains to the north, as follows: Base Camp, July 9 and 12, nos. 115–122; Base Camp to mountains north of it, alt. 5500–8000′, July 15, nos. 123–137; margins of small glacial lake near Base Camp, August 1, nos. 138–144; above Base Camp in vicinity of Mt. Tempest, alt. 5600–9000′, Aug. 2–3, nos. 145–157; Mt. Tempest, alt. 8000–9000′, Aug. 2–3, nos. 158–159; Base Camp in late August, nos. 160–164.

Collections by Dr. R. P. Sharp are from the vicinity of the right bank of Wolf Creek Glacier between the Base Camp and the mouth of Wolf Creek, Aug. 8 to Sept. 1, nos. 1–15.

List of Plants

In the following list the genera and species are arranged alphabetically within the families, except in the *Compositae* where the genera are first put into tribes. Numbers, unless otherwise stated, are those of the author's collection.

EQUISETACEAE

Equisetum palustre L. Marsh at edge of small glacial lake near Base Camp, 1941, alt. 5500′, no. 142.

PINACEAE

Picea glauca Voss. One mile above snout of Wolf Creek Glacier, south side, alt. 4700′; "typical spruce tree, 40′ high, 10½″ D B H, age about 300 years", *Sharp*, no. 14.

GRAMINEAE

Agropyron latiglume (Scribn. & Sm.) Rydb. Margin of small glacial lake near Base Camp, 1941, alt. 5500′, no. 139.—Spikelets with unusually long awns, resembling those of some Alaskan specimens, notably collections on the Seward Peninsula by Porsild, no. 1189.

Arctagrostis arundinacea (Trin.) Beal. Margin of small glacial lake near Base Camp, 1941, alt. 5500′, no. 140.

Poa arctica R. Br. Mt. Tempest, N. E. of Base Camp, 1941, alt. 8000–9000′, no. 159.—These specimens are doubtfully determined. They are densely matted and depauperate in form.

CYPERACEAE

Carex aquatilis Wahl. Damp tundra at margin of small glacial lake near Base Camp, 1941, alt. 5500′, no. 138.

Eriophorum medium Anders. *E. Chamissonis* C. A. Mey. forma *albidum* (F. Nyl.) Fern.—See Porsild in Rhodora **41:** 199 (1939) and Hultén, Fl. Kamtch **1:** 161 (1927).—Marshy land at margin of small glacial lake near Base Camp, 1941, alt. 5500′, no. 141.

Eriophorum vaginatum L. Damp meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 101.

LILIACEAE

Zigadenus elegans Pursh. Burwash Landing, Kluane L., alt. 2500′, meadows and along streams, no. 4; very common in meadows at Base Camp, 1941, alt. 5500′, no. 115.

ORCHIDACEAE

Cypripedium passerinum Richards. Meadows and woods, between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 88.

SALICACEAE

POPULUS TACAMAHACCA Mill. At snout of Wolf Creek Glacier, trees 5–15′ high, 2–3″ dia., *Sharp*, no. 1.—"Older trees on higher slopes and gravel terraces 50′ high and 1′ in trunk diameter."

SALIX ALAXENSIS (And.) Cov. Along stream near Base Camp, 1941, alt. 5500′, shrub 4′ high, no. 144; along streams at Base Camp, 1941, alt. 5500′, shrubs 6′ high, nos. 161, 162; terminal and lateral moraines of Wolf Creek Glacier, shrubs 3–10′ high, *Sharp*, nos. 2, 4; about 1 mile below snout of Wolf Creek Glacier, and 1500′ up the side of the valley, shrubs 8–10′ high, *Sharp*, no. 3.—Sharp states that this species is the commonest of the shrubby willows on the moraines about Wolf Creek Glacier.

SALIX ARBUSCULOIDES Anders. Three miles E. of Base Camp, 1939, alt. 5500′, in tundra on slope back of lateral moraine of Wolf Creek Glacier, occasional, shrubs 1½–4′ high, *Sharp*, no. 8; 1 mile above snout of Wolf Creek Glacier, associated with *Populus*, *Picea*, and *Salix glauca* var., shrubs 10–15′ high, *Sharp*, no. 9.

SALIX ARCTICA Pall. Along stream near Base Camp, 1941, alt. 5500′, no. 143; tundra above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, trailing shrub, no. 154.

SALIX BARRATTIANA Hook. Base Camp, 1941, south slope of lateral moraine of Wolf Creek Glacier, growing in a "low bushy mat, 2–4 ft. high, fairly abundant," *Sharp*, no. 10.

SALIX GLAUCA L. var. ACUTIFOLIA (And.) Schn. Along stream at Base Camp, 1941, alt. 5500′, shrub 6′ high, no. 160; gravel flat in front of Wolf Creek Glacier terminal moraine, shrubs 3–5′ high, occasional, *Sharp*, no. 13.—Number 160 appears to approach *S. niphoclada* in having very short petioles.

SALIX GLAUCA L. var. One mile above snout of Wolf Creek Glacier, associated with *Populus*, *Picea*, and *Salix arbusculoides*, shrubs 5–15′ high, up to 3″ dia., "one of the 2 dominant willows here . . . Growing in bushes but not in thickets", *Sharp*, no. 11; lateral moraine of Wolf Creek Glacier at Base Camp, 1941, alt. 5500′, shrubs 2–4′ high, *Sharp*, no. 12.

SALIX RETICULATA L. Tundra between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 125-a.

SALIX RICHARDSONII Hook. Tundra 500′ above Wolf Creek Glacier, shrubs 2′ high, abundant in places, *Sharp*, no. 6; gravel flat just below terminal moraine of Wolf Creek Glacier, *Sharp*, no. 7; north-facing slope back of lateral moraine of Wolf Creek Glacier, in tundra, shrubs 2″–1½′ high, *Sharp*, no. 5.

SALIX POLARIS Wahl. var. SELWYNENSIS Raup. Advance Base Camp, 1939, alt. 5700′, no. 79; tundra above Base Camp, 1941, alt. 5600–9000′, abundant, trailing shrub 2–3″ high, no. 153.—This material is placed here provisionally. Number 153 answers

the description written by Schneider (Bot. Gaz. **67:** 49–50) of plants collected by Shainwalt on Mt. McKinley. The writer has not seen this material, which should no doubt have further study.

BETULACEAE

Alnus crispa (Ait.) Pursh. On flat gravel terrace of small stream at snout of Wolf Creek Glacier, in thickets 10–20′ high, *Sharp,* no. 15.

POLYGONACEAE

Polygonum Bistorta L. Common in alpine meadows, Advance Base Camp, 1939, alt. 5700′, no. 48; tundra between Base Camp, 1941, and mountains north of it, alt. 5500–5700′, no. 125.

Polygonum viviparum L. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 30.

CHENOPODIACEAE

Chenopodium capitatum (L.) Asch. Along streams at Burwash Landing, Kluane L., alt. 2500′, no. 20.

CARYOPHYLLACEAE

Arenaria macrocarpa Pursh. Advance Base Camp, 1939, alt. 5700′, no. 72.

Cerastium Beeringianum Cham. & Schl. Between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 94.

Lychnis apetala L. Advance Base Camp, 1939, alt. 5700′, no. 49.

Silene acaulis L. var. exscapa (All.) DC. Advance Base Camp, 1939, alt. 5700′, no. 76.

Stellaria calycantha (Ledeb.) Bong. Meadows at Burwash Landing, alt. 2500′, no. 32.

PORTULACACEAE

Claytonia sarmentosa C. A. Mey. Advance Base Camp, 1939, alt. 5700′, no. 77; alpine slopes, between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 136.

Claytonia sp. Advance Base Camp, 1939, alt. 5700′, no. 58.

RANUNCULACEAE

Aconitum delphinifolium DC. Alpine meadows, Advance Base Camp, 1939, alt. 5700′, no. 44; shaded damp meadows above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 145.

Aquilegia brevistyla Hook. Meadows and spruce woods, Burwash Landing, Kluane L., alt. 2500′, no. 23.

Delphinium scopulorum Gray var. glaucum Gray. Mead-

ows and along streams, Burwash Landing, Kluane L., alt. 2500′, no. 15.

RANUNCULUS REPTANS L. Margin of lake above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 152.

PAPAVERACEAE

PAPAVER ALASKANUM Hultén. Advance Base Camp, 1939, alt. 5700′, no. 75; tundra above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 147.

CRUCIFERAE

ARABIS HIRSUTA (L.) Scop. var. PYCNOCARPA (Hopkins) Rollins. See Rollins in RHODORA **43:** 318 (1941).—Meadows and along streams, Burwash Landing, Kluane L., alt. 2500′, no. 14.

CARDAMINE PURPUREA Cham. & Schl. Advance Base Camp, 1939, alt. 5700′, no. 56; damp woods between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 107.

DESCURAINIA RICHARDSONII (Sweet) O. E. Schulz. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 28.

DRABA ALPINA L. Advance Base Camp, 1939, alt. 5700′, nos. 63, 73; rock slides, between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 135.—Number 73 appears to be var. *nana* Hook.

DRABA GLABELLA Pursh. Between Base Camp, 1941, and mountains north of it, alt. 5500–6000′, no. 130.

DRABA NIVALIS Lilj. Damp meadows above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 150-a.

ERYSIMUM INCONSPICUUM (S. Wats.) MacM. Meadows at mouth of Wolf Creek, alt. 3200′, no. 114.

CRASSULACEAE

SEDUM INTEGRIFOLIUM (Raf.) A. Nels. Advance Base Camp, 1939, alt. 5700′, no. 47; tundra above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 149.

SAXIFRAGACEAE

CHRYSOSPLENIUM BERINGIANUM Rose. Advance Base Camp, 1939, alt. 5700′, no. 52.

PARNASSIA KOTZEBUEI Cham. Advance Base Camp, 1939, alt. 5700′, no. 65.

PARNASSIA MONTANENSIS Fern. & Rydb. Advance Base Camp, 1939, alt. 5700′, no. 50.

PARNASSIA PALUSTRIS L. var. NEOGAEA Fern. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 12.

SAXIFRAGA BRONCHIALIS L. ssp. FUNSTONI (Small) Hultén. Advance Base Camp, 1939, alt. 5700′, no. 55.

Saxifraga caespitosa L. Mt. Tempest, alt. 8000–9000′, no. 158.

Saxifraga flagellaris Willd. Advance Base Camp, 1939, alt. 5700′, no. 62.

Saxifraga Hirculus L. Advance Base Camp, 1939, alt. 5700′, no. 57.

Saxifraga oppositifolia L. Advance Base Camp, 1939, alt. 5700′, no. 74; above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 148; rock slides between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 134.

Saxifraga rivularis L. Advance Base Camp, 1939, alt. 5700′, no. 66.

Saxifraga serpyllifolia Pursh. Damp meadows above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600′ to 9000′, no. 146.

Saxifraga tricuspidata Rottb. Rock slides near Base Camp, 1939, alt. 5500′, no. 37; rock slides between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 132.

ROSACEAE

Dryas integrifolia Vahl. Meadows near Base Camp, 1939, alt. 5500′, no. 38; Advance Base Camp, 1939, alt. 5700′, no. 71; damp woods between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 103; meadows at Base Camp, 1941, alt. 5500′, no. 117.

Fragaria glauca (S. Wats.) Rydb. Damp forest between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 99.

Potentilla biflora Willd. Advance Base Camp, 1939, alt. 5700′, no. 61.

Potentilla diversifolia Lehm. See Carn. Inst. Wash. Publ. no. **520:** 136, 152 (1940). Damp meadows above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 155.

Potentilla fruticosa L. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 13; open fields between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 84; meadows at mouth of Wolf Cr., alt. 3200′, no. 112; meadows at Base Camp, 1941, alt. 5500′, no. 122.

Potentilla nivea L. Advance Base Camp, 1939, alt. 5700′, no. 81.

Potentilla pectinata Raf. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 9.

Potentilla uniflora Ledeb. Advance Base Camp, 1939, alt. 5700′, no. 64.

Rosa acicularis Lindl. Meadows and hills at Burwash Landing, Kluane L., alt. 2500′, no. 5; meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 98.

Rubus Chamaemorus L. Meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, nos. 102, 105.

LEGUMINOSAE

Astragalus frigidus (L.) Gray. Meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 97.—This material appears to represent var. *dawsonensis* Rousseau, Contr. Lab. Bot. Univ. Montreal, No. **24:** 44–9 (1933), but is also very close to var. *littoralis* Hook.

Hedysarum alpinum L. var. americanum Michx. Meadows and along streams at Burwash Landing, alt. 2500′, no. 7; open fields between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 85.

Hedysarum Mackenzii Richards. Woods and meadows at mouth of Wolf Cr., alt. 3200′, no. 111.

Lupinus arcticus Wats. Meadows and along streams at Burwash Landing, alt. 2500′, no. 2; fields and meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 82.

Oxytropis gracilis (A. Nels.) K. Schum. Meadows and along streams at Burwash Landing, Kluane L., alt. 2500′, no. 6; open fields between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 87.—These two numbers are placed in *O. gracilis* provisionally.

Oxytropis pygmaea (Pall.) Fern. Advance Base Camp, 1939, alt. 5700′, no. 42.

Oxytropis sp. Meadows at mouth of Wolf Cr., alt. 3200′, no. 113.

LINACEAE

Linum Lewisii Pursh. Meadows and spruce woods, Burwash Landing, Kluane L., alt. 2500′, no. 27.

ELAEAGNACEAE

Shepherdia canadensis (L.) Nutt. In tundra at Base Camp, 1941, alt. 5500′, very abundant, no. 163.

ONAGRACEAE

Epilobium angustifolium L. Grassy hills and along streams at Burwash Landing, Kluane L., alt. 2500′, no. 1; meadows and burned-over woods, between Burwash Landing and Summit Camp, alt. 2500–4000′, nos. 109, 110.

Epilobium latifolium L. Meadows and along streams at Burwash Landing, Kluane L., alt. 2500′, no. 3; meadows at Base Camp, 1939, alt. 5500′, no. 35; meadows at Base Camp, 1941, alt. 5500′, no. 116.

PYROLACEAE

Pyrola grandiflora Rad. Meadows, Base Camp, 1939, alt. 5500′, no. 36; Advance Base Camp, 1939, alt. 5700′, no. 54;

damp woods between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 106.

ERICACEAE

Arctostaphylos rubra (Rehd. & Wils.) Fern. Tundra at Base Camp, 1941, alt. 5500′, very abundant, no. 164.

Ledum groenlandicum Oeder. Tundra between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 100.

Rhododendron lapponicum (L.) Wahl. Damp tundra at margin of small glacial lake near Base Camp, 1941, alt. 5500′, no. 138-a.

GENTIANACEAE

Gentiana falcata Turcz. Near Advance Base Camp, 1939, alt. 6000′, no. 80; damp meadows above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 150.—These specimens appear to form the first record of *G. falcata* in North America. They are a good match for specimens in the Gray Herbarium from the Altai Mts. of Siberia. Some of the latter have larger flowers than the American, but many agree perfectly in size and proportions. The Yukon plants resemble superficially *G. nana* Wulf. of the Carinthian Alps, but in *G. nana* the ovary is relatively short and ovate. In ours the ovary is a little longer than the corolla tube, and is lanceolate to lance-ovate. Also the calyx lobes in *G. nana* are not falcate and incurved as they are in the Yukon material and in *G. falcata*.

Gentiana procera Holm. Meadows and along streams at Burwash Landing, Kluane L., alt. 2500′, no. 21.

Gentiana propinqua Richards. Alpine meadows, Advance Base Camp, 1939, alt. 5700′, no. 43.

Gentiana prostrata Haenke. Meadows and along streams, Burwash Landing, Kluane L., alt. 2500′, no. 22; alpine meadows, Advance Base Camp, 1939, alt. 5700′, no. 40; shady forest and alpine meadow, between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 91.

POLEMONIACEAE

Phlox Richardsonii Hook. Advance Base Camp, 1939, alt. 5700′, no. 59; rock slides between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 131.—Number 131 is an excellent match for a fragment of the type of *P. Richardsonii* at the Gray Herbarium.

Polemonium acutiflorum Willd. Meadows and spruce woods at Burwash Landing, Kluane L., alt. 2500′, no. 25; along streams and in wet meadows, Advance Base Camp, 1939, alt. 5700′, no. 41; between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 126.

POLEMONIUM BOREALE Adams. Advance Base Camp, 1939, alt. 5700′, no. 39; shaded rock slides above Base Camp, 1941, found up to 9000′ on Mt. Tempest, no. 157[1].

POLEMONIUM PULCHERRIMUM Hook. Open fields between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 86.

POLEMONIUM RICHARDSONII Graham. Advance Base Camp, 1939, alt. 5700′, no. 39-a; meadows between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 127.

BORAGINACEAE

MERTENSIA PANICULATA (Ait.) G. Don. Along streams at Burwash Landing, Kluane L., alt. 2500′, no. 19; damp woods and alpine meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 95; meadows between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 124.

MYOSOTIS ALPESTRIS Schmidt. Alpine meadows, Advance Base Camp, 1939, alt. 5700′, no. 45; meadows between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 123.

SCROPHULARIACEAE

CASTILLEJA PALLIDA (L.) Spreng. ssp. ELEGANS (Ostenfeld) Pennell. Slopes of rocky moraines, between Base Camp, 1941, and mountains north of it, alt. 8000′, no. 137.

LAGOTIS GLAUCA Gaertn. Advance Base Camp, 1939, alt. 5700′, no. 67.—This specimen lacks the lower stem and leaves, but probably represents the var. *lanceolata* Hultén.

PEDICULARIS CAPITATA Adams. Alpine slopes between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 133.

PEDICULARIS LABRADORICA Wirsing. Advance Base Camp, 1939, alt. 5700′, no. 53.

PEDICULARIS SUDETICA Willd. Meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 104.

PEDICULARIS VERTICILLATA L. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 8; Advance Base Camp, 1939, alt. 5700′, no. 69; meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 90; meadows at Base Camp, 1941, alt. 5500′, no. 118.

PENSTEMON GORMANII Greene. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 24.

RUBIACEAE

GALIUM BOREALE L. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 31.

[1] The writer is indebted to Dr. E. T. Wherry for the determination of specimens cited under *P. boreale* and *P. Richardsonii*.

VALERIANACEAE

VALERIANA CAPITATA Pall. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 11; meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 108.

COMPOSITAE

SOLIDAGO DECUMBENS Greene var. OREOPHILA (Rydb.) Fern. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 34.

SOLIDAGO MULTIRADIATA Ait. Advance Base Camp, 1939, alt. 5700′, no. 46; meadows at Base Camp, 1941, alt. 5500′, no. 120. Number 46 appears to represent var. *arctica* (DC.) Fern.

ASTER ALPINUS L. Burwash Landing, Kluane L., alt. 2500′, no. 17; between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 93.

ASTER SIBIRICUS L. Meadows at Burwash Landing, alt. 2500′, no. 16; Advance Base Camp, 1939, alt. 5700′, no. 78; fields between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 92; meadows at Base Camp, 1941, alt. 5500′, no. 119.

ERIGERON ELATUS Greene. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 29.

ERIGERON RADICATUS Hook. Advance Base Camp, 1939, alt. 5700′, no. 60.

ERIGERON UNALASCHKENSIS (DC.) Vierh. Advance Base Camp, 1939, alt. 5700′, no. 70; rock slides between Base Camp, 1941, and mountains north of it, alt. 5500–8000′, no. 129.

ACHILLEA BOREALIS Bong. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 10; open fields between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 83.

ARTEMISIA ARCTICA Less. Advance Base Camp, 1939, alt. 5700′, no. 68.

ARNICA ATTENUATA Greene. Meadows between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 96.

ARNICA LONCHOPHYLLA Greene. Meadows at Burwash Landing, Kluane L., alt. 2500′, no. 18.

SENECIO LUGENS Richards. Fields between Burwash Landing and Summit Camp, alt. 2500–4000′, no. 89; meadows at Base Camp, 1941, alt. 5500′, no. 121.

SENECIO RESEDIFOLIUS Less. Advance Base Camp, 1939, alt. 5700′, no. 51.

SAUSSUREA DENSA (Hook.) Rydb. Rock slides above Base Camp, 1941, vicinity of Mt. Tempest, alt. 5600–9000′, no. 151.

CREPIS NANA Richards. Gravel slides, Burwash Landing, Kluane L., alt. 2500′, no. 26.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXLVIII

M. L. Fernald

(*Continued from page 303*)

VIII. NOTES ON HIERACIUM

Hieracium **Robinsonii** (Zahn), stat. nov. *H. smolandicum*, subsp. *Robinsonii* Zahn in Engler, Pflanzenr. iv[280]. 468 (1921).

Although Zahn placed with doubt the plant collected by Robinson & Schrenk in southeastern Newfoundland under the Scandinavian *H. smolandicum* Almq. it differs in so many strong characters that I think it wiser to consider it an endemic eastern American species. So far as I have yet found there is no evidence that any of the European members of the complex Section *Vulgata* are indigenous with us. We have a very diverse lot of introduced and weedy plants of the section. *H. Robinsonii*, however, is indigenous along chiefly slaty river-banks in Newfoundland, eastern Quebec, Cape Breton, northern Maine and northern New Hampshire. From the Scandinavian *H. smolandicum* our native plant differs in its thick and firm leaves glabrous beneath or merely short-pilose along the midrib, the cauline leaves twice as many, mostly 4–10, and more gradually decreasing in size to the summit (in *H. smolandicum* the thin leaves copiously long-villous, the cauline 3–6 and confined chiefly to lower half of stem), and the phyllaries caudate-attenuate (in *H. smolandicum* blunt or merely acuminate).

It is at present quite impossible to identify with any certainty the diverse series of introductions belonging in the macro-species *Hieracium vulgatum*. In his inclusive *H. vulgatum* Zahn recognizes 144 so-called "subspecies" and many varieties, the subspecies sometimes grouped under such unilluminating heads as "*a*. Folia latiora" opposed to "*b*. Folia angustiora" or "a. Squamae dorso vel margine parcefloccosae" opposed to "b. Squamae efloccosae atrae nitentes", the latter series containing "subspecies" with "Involucra . . . interdum parcefloccosa" (subsp. no. 131) or "squamis . . . parcefloccosis" (subsp. no. 132), the former series with "subspecies" with "squamis . . . subefloccosis". In other cases series of 20 or 30 "subspecies" are enumerated without even these hair-

splitting differentiations. Surely, without a clearer understanding of and a saner guide to the European variations of this heteromorphic group, it is better for the present to pass all the introduced plants of § *Vulgata*, with basal leaves narrowed to the petiole as *H. vulgatum*.

Returning to *Hieracium Robinsonii*, Zahn's very full description of the *Robinson & Schrenk* plant is accompanied by the following synonymy: "An *H. molle* Pursh Fl. Am. sept. II, (1816) 503? *H. vulgatum* Gray Syn. Fl. N.-Am. I. 2 (1884) 429". As to the plants of the Synoptical Flora designated by Gray (on p. 424, not 429) as *H. vulgatum* from "Labrador, *Kohlmeister*, &c. Canada, on shores of the Lower St. Lawrence (*Macoun*), there perhaps introduced", they are of two very different species. The Labrador element is *H. groenlandicum* Arv.-Touv., which is native in outer Labrador, northern Newfoundland, and Anticosti, as well as Greenland, while the Macoun material seen by Gray was a sheet of Macoun's (August, 1883) with two species, the data reading: "Shores of the St Lawrence from Point Levis to Anticosti. Locality. Point Levis (Large specimen), River de Brig, Anticosti". The plant from Levis is the ubiquitous weedy species which abounds in the region of Quebec city, *H. vulgatum* Fries; the Anticosti specimen is good *H. groenlandicum*. As for *H. molle* sensu Pursh, not Jacquin, that was evidently *H. groenlandicum* also; incidentally the date of Pursh was 1814, not 1816 as given by Zahn.

The type and only specimen of *H. Robinsonii* seen by Zahn came from the southeastern side of Newfoundland, more than 550 miles southeast of the mouth of the St. Lawrence River[1]. Nevertheless Zahn, with the Germanic inaccuracy regarding American geography to which we have become accustomed, concocted the citation: "Am unteren Lorenzstrom: Cataracts of Rocky River in Newfoundland". The following are the stations for *H. Robinsonii* (often distributed as *H. vulgatum*) represented in the Gray Herbarium and the Herbarium of the New England Botanical Club.

NEWFOUNDLAND: crevices of rocks, infrequent, South Arm River, Holyrood, and Cataracts of Rocky River, *Robinson &*

[1] Equivalent in distance to placing Berlin in England, on the western coast of Norway, on the Gulf of Riga, on the Dneiper River or on the Mediterranean, or equivalent in distance to placing Vienna on the Seine or in Belgium or on Sardinia.

Schrenk, no. 227 (ISOTYPE); ledges and gravel along Waterford River between Waterford Bridge and St. John's, *Fernald & Wiegand*, no. 6439. QUEBEC: Saguenay River, Roberval, July 18, 1892, *G. G. Kennedy;* ledges along River Ste. Anne des Monts, Gaspé County, August, 1905, *Collins & Fernald;* ledges below Fraser Falls, Rivière du Loup, July 11 and 13, 1904, *Collins & Fernald;* rocks by Lower Fall, Rivière du Loup, *A. S. Pease*, no. 2477. NOVA SCOTIA: gravel in river-bottoms, Big Intervale, Cape Breton Island, *Macoun*, no. 16,699. MAINE: argillaceous ledges by Meduxnakeag River, Monticello, *Fernald & Long*, no. 14,923; abundant in crevices of calcareous ledges and on cliffs by Mattawamkeag River, at foot of the Island, Island Falls, September 8, 1897, *Fernald;* cliffs (calcareous slate) along Piscataquis River, Sangerville, June 26, 1895, *Fernald*, no. 236; July 15 and 29, 1900, *W. N. Park;* rocky soil about ledges, Carrabassett River, North Anson, July 4, 1885, *J. F. Collins.* NEW HAMPSHIRE: ledges, Gorge of Diamond River, Dartmouth College Grant, Coös County, *Pease*, no. 10,513.

It may be serviceable to others to have my key-characters separating the 4 species of § *Vulgata* which I can recognize in eastern America:

a. Stem truly scapiform or subscapiform, naked or with 1 or 2 cauline leaves borne near base; lowest leaves with rounded or cordate bases.....*H. murorum* L. (locally adventive from Europe).

a. Stem with 2–12 leaves scattered to near inflorescence; lower leaves attenuate to petioles....*b.*

b. Involucre and pedicels stipitate-glandular, with no or but few glandless villi overtopping the glands; inflorescence paniculate-corymbose, with arched- or divergent-ascending branches and pedicels; heads few—30 or more. *H. vulgatum* Fries (All-inclusive series of introductions).

b. Involucre and pedicels glandless or only very minutely glandular, copiously long-pilose or villous with glandless hairs; inflorescence strict, with 1–10(–20) heads on erect peduncles or branches; indigenous.

Larger (lower) leaves 1–5 cm. broad, membranaceous, villous-ciliate, their petioles and the midribs of lower surfaces copiously villous; heads (1–)4–20; phyllaries blunt or acuminate.....*H. groenlandicum* Arv.-Touv.

Larger (lower) leaves 0.7–2 cm. broad, coriaceous, eciliate or nearly so, their petioles and the midribs of lower surfaces only sparsely pilose or glabrescent; heads 1–5(–8); phyllaries caudate-attenuate.....*H. Robinsonii.*

The stations known to me for *H. Robinsonii* are given above. Those of *H. groenlandicum* (outside Greenland) are as follows:

LABRADOR: Rama, *A. Stecker*, no. 347; open hillside, September Harbor, lat. 56° 31′, long. 61° 10′, *Bishop*, no. 608. NEWFOUNDLAND: thickets on slaty hills back of Little Quirpon, *Fernald &*

Gilbert, no. 29,268; thicket by Big Brook, Straits of Belle Isle, *Fernald & Long*, no. 29,267. ANTICOSTI ISLAND, QUEBEC: talus calcaire et barachois, Rivière au Saumon, *Victorin et al.*, no. 21,303; sur les platières élevées et sèches, R. au Saumon, *Victorin & Rolland*, no. 27,583; R. de Brig [c ?], *Macoun*, no. 18, in part; R. la Loutre, *Victorin & Rolland*, nos. 25,356–25, 358; à plusieurs milles en amont, R. Jupiter, *Victorin & Rolland*, no. 25,360; sur les platières sèches, R. du Brick, *Victorin & Rolland*, no. 27,579; sur la rocaille calcaire près de l'embouchure, R. à la Patate, *Victorin et al.*, no. 21,310; talus herbeux, R. Galiote, *Victorin & Rolland*, no. 25,359; sur les talus des gorges, R. Chicotte, *Victorin & Rolland*, no. 27,587; éboulis argilo-calcaires, R. Ferrée, *Victorin & Rolland*, no. 25,355; sur les talus d'alluvion, R. Belle, *Victorin & Rolland*, no. 27,591.

H. CANADENSE Michx., var. **fasciculatum** (Pursh), stat. nov. *H. fasciculatum* Pursh, Fl. Am. Sept. ii. 504 (1814).

Var. *fasciculatum* is the common plant which passes in the Northern States and southern Canada as typical *Hieracium canadense*. It is, however, not the extreme of the species which Michaux had, from Lake Mistassini, and well described as *H. canadense* in his Fl. Bor.-Am. ii. 86 (1803). Michaux clearly described, and the beautiful photograph before me of his TYPE shows, the northern extreme, mostly low, with few large and remote thin leaves and open paniculate-corymbose inflorescence of few long-peduncled heads with blackish involucre of oblong-lanceolate phyllaries. Typical *H. canadense* occurs from southern Labador to northern British Columbia, south to Newfoundland (where nearly ubiquitous), Cape Breton, Prince Edward Island, northern Maine, northern New Hampshire, Ontario, northern Michigan, northeastern Iowa, Saskatchewan, Montana, Idaho and Oregon. It is the plant which in the West passes as *H. columbianum* Rydb. or *H. canadense*, var. *columbianum* (Rydb.) St. John. It was also described as *H. macrophyllum* Pursh, Fl. Am. Sept. ii. 504 (1814), Pursh noting the distinctive characters, "panicula divaricato-corymbosa, pedunculis elongatis nudis", which is quite similar to Michaux's "corymbo paucifloro: pedunculis longis". Pursh also added the significant comment: "leaves the largest of the genus".

Var. *fasciculatum* is the common plant which occurs from southern Quebec to southern Ontario and Minnesota, south to Nova Scotia, New England, northern New Jersey, Pennsylvania, Ohio, Indiana, Illinois and Iowa. It was described by Pursh

"caule erecto folioso . . . ramis paniculae divaricatis brevibus, pedicellis subfasciculatis pubescentibus". It was also described by Pursh (p. 503) from western New York and Canada as *H. virgatum.*

Torrey & Gray understood typical *Hieracium canadense* and its var. *fasciculatum* but, without knowing Michaux's type, they reversed the two, calling var. *fasciculatum* typical *H. canadense* and treating the northern typical *H. canadense* (*H. macrophyllum* Pursh) as *H. canadense,* var. *latifolium* Torr. & Gr. Fl. N. Am. ii. 476 (1843). As I understand the species it falls into three well defined varieties as follows:

a. Involucre 8–13 mm. high; upper internodes of stem and branches without or with only a few scattered setae.
  Involucre dark fuscous to blackish; median phyllaries oblong-lanceolate, 1.5–2 mm. broad, the inner ones fuscous throughout or with broad dark central band; stems 1.5–10 dm. high; leaves (5–)8–20(–30), mostly remote, thin or membranaceous to firm, oblong or narrowly ovate, lanceolate or oblanceolate; heads 1–many, on arched-ascending peduncles mostly 2–10 cm. long in an open or divaricately corymbiform panicle. . . *H. canadense* (typical).
  Involucre pale olive; median phyllaries narrowly lanceattenuate, 1–2 mm. broad at base, the inner ones pale throughout or merely with slender greenish midrib and green tip; stems mostly 0.5–1.5 m. high, stiffly erect; leaves 25–50 or more, often subapproximate, lanceolate to narrowly oblong-ovate, thick to coriaceous; heads many, often subvirgately fascicled or subumbellately corymbose, on stiff peduncles mostly 0.5–4 cm. long. . . . . Var. *fasciculatum.*

a. Involucres 5–10 mm. high; panicle more or less virgate-fastigiate to umbelliform, with slender and erect elongate peduncles; stem slender, 0.5–9 dm. high, its middle and upper internodes and the peduncles copiously villous-hirsute with hairs 1.5–3 mm. long; leaves as in typical var. or the lower more strongly ciliate. . . . . Var. *hirtirameum.*

H. CANADENSE Michx. Fl. Bor.-Am. ii. 86 (1803). *H. macrophyllum* Pursh, Fl. Am. Sept. ii. 504 (1814). *H. canadense,* var. *latifolium* Torr. & Gray, Fl. N. Am. ii. 476 (1843). *H. auratum* sensu Fries, Epic. Gen. Hierac. 124 (1862) not Fries, Symb. Hist. Hierac. 181 (1848). *H. columbianum* Rydb. in Bull. Torr. Bot. Cl. xxviii. 513 (1901). *H. canadense columbianum,* as subsp. (Rydb.) Piper in Piper & Beattie, Fl. Se. Wash. 351 (1914). *H. canadense,* var. *macrophyllum* (Pursh) Farwell in Rep. Mich. Acad. Sci. xx. 195 (1918). *H. laevigatum* subsp. *canadense* (Michx.) Zahn in Engler, Pflanzenr. iv[280]. 891 (1922). *H. canadense,* var. *columbianum* (Rydb.) St. John, Fl. Se. Wash. and Adj. Idaho, 459 (1937).—Range given above.

Var. FASCICULATUM (Pursh) Fernald, supra. *H. fasciculatum* Pursh, Fl. Am. Sept. ii. 504 (1814). *H. virgatum* Pursh, l. c. 503 (1814). *H. Kalmii* sensu Bigel. Fl. Bost. ed. 2: 288 (1824); sensu Torr. Compend. 280 (1826); sensu Spreng. Syst. iii. 646 (1826); not L. Sp. Pl. ii. 804 (1753).—Range given above.

Var. HIRTIRAMEUM Fernald in RHODORA, xvii. 19 (1915).—Damp to dry ledges, shores, cliffs and clearings, Newfoundland to Wisconsin, south to New Brunswick, New England and northeastern Pennsylvania.

As originally pointed out Var. *hirtirameum* is more inclined than other variations of the species to distortions due to aphids or fungi. Some altered individuals show secondary involucres only 2 mm. high.

As to *Hieracium Kalmii*, it was said by Linnaeus to have been collected in Pennsylvania by Kalm. The type, of which two different photographs are before me, looks like a meagre specimen of *H. canadense*, var. *fasciculatum*, for which Bigelow, Torrey and Sprengl mistook it. Its involucre, however, is less imbricated, with the phyllaries obtuse; and after studying the specimen Gray wrote: " . . . Scales of involucre narrowly linear, . . . in a single series . . . Ovaries . . . glabrous, not striate . . . Pappus a single series of fragile strongly denticulate-scabrous bristles . . . ; we are confident that his plant is not of North American origin".—Gray in Torr. & Gray, l. c. 479 (1843).

In describing *Hieracium canadense* Michaux compared it with the European *H. sabaudum* L., a species which superficially suggests typical *H. canadense*, but from which our native plant differs consistently in many characters. Since the European species is appearing locally as a weed with us it may here be recorded.

H. SABAUDUM L. Differing from *H. canadense* as follows: Hairs of lower internodes and leaf-surfaces bulbous-based; panicle occupying one third to two thirds the height of the plant, loosely paniculate, not umbelliform; involucre glabrous or with few nonglandular hairs (young involucre of *H. canadense* commonly somewhat glandular); phyllaries round-tipped, the lowest spreading (in *H. canadense* at least the inner phyllaries attenuate to tip, all appressed).—Sp. Pl. ii. 804 (1753).—Old World species becoming naturalized with us. I have examined the following American material. MASSACHUSETTS: vacant grassy lot, Memorial Drive near Cottage Farm Bridge, Cambridge, October 6,

1928, *S. F. Blake*, no. 10,789, the plant now abundant and found elsewhere in Cambridge; abundant in vacant lot off Pleasant Street, Brookline, September 29, 1913, *F. F. Forbes*.

H. VENOSUM L., var. NUDICAULE (Michx.) Farwell in Mich. Acad. Sci. Rep. xx. 194 (1918). *H. Gronovii*, var. α. *nudicaule* Michx. Fl. Bor.-Am. ii. 87 (1803).

In making this transfer Dr. Farwell did not clearly differentiate between true *Hieracium venosum* and the variety. From the start the two Linnean species, *H. venosum* L. Sp. Pl. ii. 800 and *H. Gronovii* L. l. c. 802 (1753), were hopelessly mixed. As noted by Gray in Torrey & Gray, Fl. N. Am. 478 (1843) and as is apparent from the Linnean diagnoses his description of *H. venosum*, drawn directly from Gronovius, calls for a thick-stemmed plant: "HIERACIUM foliis cuneiformibus hirtis, scapo nudo crassissimo erecto"; while the very detailed description of *H. Gronovii*, "Folia *radicalia obovata, obtusa, integerrima, tenuitate membranacea, supra pilis raris adspersa, subtus subviolacea.* Caulis *pedalis, filiformis, uno alterove folio lanceolato, paniculatus, panicula inaequali*", vividly describes the plant which Willdenow, Sp. Pl. iii. 1570 (1804), Torrey & Gray and all later authors have called *H. venosum.* There is no type of *H. venosum* in the Linnean Herbarium but the citations by Linnaeus of the two Virginian plants, *Hieracium . . . lapathi venis sanguineis inscriptis foliis* of Plukenet and *H. . . . foliis punctis & venis sanguineis notatis* of Banister, and the descriptive name *H. venosum* can mean only the plant we know under that name. Willdenow and after him Torrey & Gray so used the name and, in view of the sad mixup at the start, this seems the right interpretation. As to *H. Gronovii*, as badly mixed, Gray, who studied the specimens involved, selected the plant of Gronovius cited by Linnaeus to typify that confused name.

Hieracium venosum may have strictly rosulate leaves and a naked scape or 1–6 cauline leaves, the latter series of selected specimens being *H. venosum*, var. β. *subcaulescens* Torr. & Gray. Experience in the field shows that it has no definite range and that individuals with and without cauline leaves are frequently associated. Taxonomically it seems wholly unimportant. So, it seems to me, is var. *Blombergii* Zahn in Engler, Pflanzenr. iv[280]. 1117 (1922). Its only character, the presence of abundant glands on the involucre, is altogether too evasive. Just where one

stops in estimating whether the involucre may be "tenuiter subglandulosa" (Zahn's characterization of typical *H. venosum*) and "densissime glandulosa" I do not know. Var. *Blombergii* was based on a single collection from Massachusetts. Of the 105 specimens from that state before me 6 show no appreciable glands on the involucre, 89 have them obvious but possible to count (from 1 to 6 or 8 on a phyllary) and could be described by Zahn's "tenuiter subglandulosa", and 10 specimens have enough glands to pass as "densissime glandulosa". I give up.

There seems to be, however, a very real geographic variation within *Hieracium venosum*. All material before me from New England (with the exception of a few sheets from Cape Cod, Martha's Vineyard and Nantucket) to southern Ontario, south into Pennsylvania and Kentucky, has the upper surfaces of the later and abundant basal leaves quite glabrous, although the smaller basal ones may have setose upper surfaces. Much of the material from Georgia to New Jersey and a few specimens from southeastern Massachusetts have the upper surfaces remotely setose with thick-based hairs. Thus, of the relatively small but significant representation before me 14 sheets (including all from south of lat. 38°) from Virginia have setose upper surfaces, only 2 (both from north of lat. 38° 30′) have them glabrous; 8 (all but 2 from the outer Piedmont or the Coastal Plain) from North Carolina have setose upper surfaces, 7 (all from the mountains) not; 3 from South Carolina setose, 0 glabrous; 5 from Georgia setose, 1 (from Pine Mt.) glabrous; and all from Missouri setose. The setose upper surface, as opposed to the esetose one, seems to mark a real geographic variation. In view of the fact that all our collections from the regions best known to Banister (and through him Plukenet) and to Clayton (and through him Gronovius) have the setose upper surfaces ("foliis . . . hirtis—*Gronovius;* "Folia *tenuitate membranacea, supra pilis raris adspersa*"—*Linnaeus*), I am treating the common plant of southeastern Virginia as typical of the species as recognized by Willdenow and by Torrey & Gray and later authors.

Michaux did not even recognize *Hieracium venosum*. He lumped the two very different plants, one with elongate subcylindric inflorescences, thick green foliage and stoutish stems, the other with open corymbiform panicle, often purple-marked

membranous foliage and slender stems as *H. Gronovii*. Under that inclusive name he had two varieties:

Var. α. *nudicaule:* caule subunifoliato: panicula subfastigiata.
— β. *foliosum:* caule parce folioso: panicula oblonga.
HAB. β. in Virginia et Carolina.
— α. in Canada et Pensylvania.

The photograph of Michaux's material which I took in 1903 shows the two plants: his *H. Gronovii*, α. *nudicaule*, the common northern extreme of *H. venosum* with leaves glabrous above. The label bears the annotation "État de N. York et Pensylvanie" and the significant note: "calyce pedunculisq. hispidis", which places it perilously near "var. *Blombergii*"!, so that the latter name must lapse with those who think the more glandular specimens worth sorting out. *H. Gronovii*, var. *foliosum* Michx. is very characteristic *H. Gronovii* as now generally interpreted, the plant with 2–10 well developed and scattered cauline leaves. The occasional more leafy individuals, with 20–30 cauline leaves seem not worth separating, at least, they are not var. *foliosum*.

The highly plastic series of plants known as *Hieracium marianum* Willd. seems to be a group of more or less perpetuating hybrids with *H. venosum* as one parent, *H. Gronovii* often, or northward *H. scabrum* Michx., as the other. The resultant maze is very complex. It is our nearest approach to the baffling series of apomicts and mixed progeny with which the European students of *Hieracium* are familiar.

THE WILD CHERRY OF THE CARRIZO SANDS OF TEXAS

V. L. Cory

My very good friend, Mr. H. B. Parks, from time to time has called to my attention the fact that the wild cherry of the sand hills along the Bexar-Wilson County line is different from the other described species of cherries, and to substantiate his statements at various times he has sent me material of this plant for study. Some of the fruiting material thus received was sent to a leading botanist for determination, and by him it was referred to *Prunus virens* Woot. & Standl., the evergreen cherry, which, in Texas, is found only in the mountains of the Trans-

Pecos Area. Moreover, observations and abundant material show that our plant is deciduous, and it is known to differ otherwise from *P. virens*. I take great pleasure in naming this new cherry in honor of its discoverer, my esteemed co-worker, Mr. H. B. Parks.

Prunus **Parksii,** n. sp. Plant a small tree, 3–5 meters high, with a definite trunk which is up to 7 cm. in diameter, and a few slender, drooping branches; bark of trunk gray to almost black with a hard, even pebbled surface; bark of upper trunk and branches smooth, reddish-brown, exfoliating; leaves early deciduous, thick, bright green and glabrous on both surfaces with exception of the midrib below which for one-half its length or more is densely clothed with a rufous tomentum, elliptic-ovate, up to 7 cm. long and 4 cm. broad, the shorter leaves frequently being ¾ as broad as long, usually narrowed to the base, finely crenulate-serrate, the teeth appressed and black-glandular-tipped, relatively short-petioled; petioles more or less tawny-pubescent, slender, bearing 2 petiolar glands at base of leaf-blade, 5–7 mm. long, frequently about one-tenth the length of the leaf-blade; rhachis of the inflorescence tawny-pubescent below and glabrous above; pedicels stout, 6–7 mm. long; petals broader than long, 2 mm. broad, white, yellowish at base; hypanthium and sepals persistent, glabrous, the hypanthium saucer-shaped, usually with 3 subulate processes, which are up to 2 mm. long, in between the 5 broadly triangular lobes, which are 1 mm. long or less; fruit red, not fleshy, glabrous, globose, 5 mm. in diameter, sessile in the hypanthium.

Prunus **Parksii,** sp. nov. Arbuscula, 3–5-metralis, trunco primario evoluto ad 7 cm. crasso ramos nonnullos inclinatos edente; trunci cortice griseo vel nigricante aequa ratione undique sat minute fissurato, ramorum levi, brunneo-rubro exfoliante; foliis citius deciduis, crassis, utrinque laete viridibus glabrisque costa subtus excepta ad medium vel parum supra tomento rufo denso induta, elliptico-ovatis, ad 7 cm. longis, 4 cm. latis, foliis brevioribus saepius parte quarta longioribus quam latis, pro more basi angustatis, minute crenulato-serratis, dentibus adpressis nigro-glandulosis, sat breviter petiolatis; petiolis plus minusve indumento rufido obtectis, gracilibus, basi laminae glandulis petiolaribus 2 onustis, 5–7 mm. longis, saepius decima parte laminae longitudine; inflorescentiae rachi deorsum fulvo-pubescente sursum glabro; pedicellis crassis, 6–7 mm. longis; petalis latioribus quam longis, 2 mm. latis, albis, basi lutescentibus; hypanthio cum sepalis persistente, glabro, latius cyathiformi, pro more processubus subulatis 3 armato, ad 2 mm. longis inter lobos 5 late triangulares ca. 1 mm. longos positis; fructu rubro, haud carnoso, globoso, 5 mm. crasso, in hypanthio sessili.

The new species is a deciduous cherry closely related to *P. serotina* and to *P. eximia*. It differs from *P. serotina* in being a low-growing tree, in having fruits that are red instead of black and which contain little or no pulp, and in being early-deciduous. In general the new species differs from *P. eximia* in being a much smaller tree with markedly fewer branches which are less abundantly leafy, and with the foliage early deciduous (*P. eximia* seen in Polecat Canyon, December 13, 1942, still retained its more abundant foliage). In particular other contrasts between the new species and *P. eximia* are that the twigs and petioles of the former species are somewhat pubescent and the lower part of the rhachis of the inflorescence is decidedly pubescent while in the latter species these parts are glabrous, and in the former species the leaves are thick, have a finely crenulate-serrate margin, with a relatively broad blade, and a relatively short petiole, while in the latter species the leaves are thin, have a coarsely crenulate-serrate leaf-margin, with a relatively narrow blade, and a longer petiole (as much as thrice as long). The new species is known only from the Carrizo Sands and neither *P. serotina* nor *P. eximia* grow on this formation. It is found growing in depressions of the Carrizo Sand Area of Texas. Mr. Parks knows of three locations of this species in localities separated by many miles, these being in Bexar, Wilson, and Guadalupe Counties. He comments that some plants at each locality indicate extreme old age, and that the largest plant he has seen had a trunk three inches in diameter at one foot above the ground. He further comments that the flowers appear after the leaves in the month of April, and that the fruits are ripe and that the leaves drop by the first of September.

No. 23626, collected by H. B. Parks, May 25, 1937, along the county line road between Bexar and Wilson Counties, in Wilson County, near Kicaster, is designated as the type specimen. It is deposited in the Gray Herbarium. Representative material is available to other herbaria upon request.

I wish to express grateful appreciation to Dr. Leon Croizat for valuable assistance given me in the preparation of the Latin description in this manuscript.

Substation No. 14, Sonora, Texas

A NEW AMSONIA FROM THE OZARKS OF ARKANSAS

Robert E. Woodson, Jr.

During the fall of 1942, my friend Leslie Hubricht brought to my attention a dried specimen of an Amsonia which he had collected in Garland County, Arkansas, and which he considered distinct from the narrow-leaved Amsonia of the "bald knobs" of the Missouri and Arkansas Ozarks currently treated as *A. ciliata* var. *filifolia* Wood. At the time, I was quite sceptical and insisted upon waiting until living plants, which Mr. Hubricht had thoughtfully obtained, had bloomed in the experimental plots of the Missouri Botanical Garden. These plants have now bloomed, and a comparison with the plants from the bald knobs, which we have had growing in the Garden for many years, completely vindicates their separation. Furthermore, upon re-examining the series labelled as *A. ciliata* var. *filifolia* in the herbarium of the Missouri Botanical Garden, I find that many so labelled from Arkansas are really the new species, also represented by a single collection in the adjacent Ouachita Mountains of Oklahoma. I have thought it fitting to associate Mr. Hubricht's name with this fine new species:

Amsonia **Hubrichtii** Woodson, spec. nov. Herbae perennes, caulibus pluribus vel numerosis ca. 4.5–6.0 cm. altis superne sub inflorescentiam ramosis inferne simplicibus omnino glabris. Folia irregulariter approximata plerumque sat congesta linearia brevissime petiolata acuminata ca. 5–9 cm. longa 0.4–0.5 cm. lata crassiuscule membranacea supra saturate viridia illustria nervo medio lato albo notata nervis secundariis conspicuis subtus pallidiora. Inflorescentia paniculata multiflora sessilis vel brevipedunculata ramulis caulis sterilibus haud superantia; floribus amabile caeruleis, pedicellis ca. 0.5 cm. longis, calycis laciniis triangularibus acuminatis ca. 0.15 cm. longis margine conspicue scariosis glabris, corollae extus omnino glabrae tubo hypercrateriformi ca. 0.7 cm. longo basi ca. 0.15 cm. ostio ca. 0.3 cm. diametro lobis oblongo-lanceolatis acutis ca. 0.6 cm. longis 0.2 cm. latis patulis. Folliculi anguste fusiformes 9–15 cm. longi ca. 0.3 cm. crassi glabri; seminibus cylindricis oblique truncatis ca. 0.9 cm. longis 0.15 cm. crassis.

Arkansas: clark: on Washita River, Arkadelphia, Aug. 25, 1883 (fruit) *G. W. Letterman s. n.;* rocky creek-bottoms, exact locality lacking, Oct. 26, 1932 (fruit), *D. Demaree 9988;* garland: shale outcrop subject to overflow, margins of Ouachita near Hot Springs, April 22, 1924, *E. J. Palmer 24479;* Hot Springs, Aug. 5,

1879 (fruit), *G. W. Letterman s. n.;* creek-bottoms, Hot Springs, April 30, 1939, *D. Demaree 19027;* rocks in creek-bottoms, Magnet Cove, April 8, 1939, *D. Demaree 18856;* LOGAN: along bed of rocky branch, near Blue Mountain, May 11, 1924, *E. J. Palmer 24811;* PIKE: Prairie Creek, gravel bars, Murfreesboro, Sept. 29, 1932 (fruit), *D. Demaree 9381;* YELL: along stream 3.2 mi. west of Birta, May 4, 1940, *L. Hubricht B1800* (TYPE, Herb. Missouri Bot. Gard.). OKLAHOMA: MCCURTAIN: rocky creek-beds, Broken Bow State Park, May 16, 1936, *D. Demaree 12654.*

All the specimens cited are deposited in the herbarium of the Missouri Botanical Gardens, but duplicates of most presumably are to be found in other American herbaria.

Amsonia Hubrichtii strikingly recalls *A. illustris* by its habitat in rocky or gravelly creek-bottoms of the Ozark region; but the latter, of course, has much broader leaves and externally pubescent corollas. Its closest relative apparently is the Ozark phase of *A. ciliata* var. *filifolia*, which, however, is much less in stature, with dull foliage, definitely pedunculate inflorescences held well above the leafy shoots beneath them, and somewhat larger, broader corollas.

In the perennial borders of the Missouri Botanical Garden, *A. Hubrichtii* has proved to be a much more satisfactory plant than the "*A. tabernaemontana*" (frequently actually *A. illustris*) offered by many nurserymen. It is a neater plant of more refined growth, the foliage is ornamental, and the clearer blue flowers are displayed to better advantage. The Ozark phase of *A. ciliata* var. *filifolia* is also a satisfactory and long-lived border perennial with something of the grace of *Linum perenne.*

MISSOURI BOTANICAL GARDEN,
WASHINGTON UNIVERSITY,
ST. LOUIS, MISSOURI.

POTAMOGETON SPIRILLUS MAY GROW AS AN ANNUAL

W. C. MUENSCHER

THE small pondweed, *Potamogeton Spirillus* Tuckerman, is usually described as possessing stems "arising form slender forking rootstocks". During several seasons while observing seedlings of species of Potamogeton in the field, it was noticed that

P. Spirillus growing in Oquaga Lake, Broome County, New York, had neither rootstocks nor winter buds at the base of the plants. Field studies in 1941 and 1942 disclosed that the plants started from seeds germinating in early May and matured fruits by August and September of the same year. During this entire period the plants retained the primary root even though some adventitious roots developed from the lower nodes of the more or less erect stem. The shell of the old "seed" remained attached at the junction of the base of the stem and primary root.

A search made in early spring and at intervals later failed to reveal a single plant that had started from overwintered structures and not a single plant was found with a rootstock; all had primary roots and seeds attached at the base. Apparently, in this locality, *P. Spirillus* performs as an annual. Oquaga Lake is a clear, cold, spring-fed lake. The *P. Spirillus* grows in 1 to 2 meters of water. Specimens taken July 2, no. 20631, and September 6, 1941, no. 20632, have been deposited in the herbarium of Cornell University.

Since this species is known to have rootstocks or at least more or less horizontal stems with roots at the nodes, an examination was made of all the specimens in the herbarium of Cornell University to determine whether any of them indicated the annual habit. The following sheets of *Potamogeton Spirillus* collected in New York State, all contain fruiting plants with the primary root and pericarp of the germinated "seed" (nutlet), still intact:

Upper Chateaugay Lake, Clinton Co., September 11, 1930, Muenscher and Bassett Maguire, no. 744; on sandy bottom, growing with *Potamogeton Vaseyi* in Millsite Lake, Jefferson Co., July 10, 1931, Muenscher and Maguire, nos. 1624 and 1625; Cheyney Pond, Essex Co., August 23, 1932, Muenscher and A. A. Lindsey, no. 2846; Sacandaga Lake, Hamilton Co., July 26, 1932, Muenscher and Lindsey, no. 2855; Cayuta Lake, Schuyler Co., July 5, 1931, Muenscher, no. 17548 and August 9, 1933, Muenscher and V. M. Lefler, no. 18252. In addition, a sheet of plants collected August 11, 1911 (Fernald and Wiegand 4492), in Rushy Pond, in Newfoundland also has specimens with the primary root and the old "seed" still attached.

Most students of Potamogetons, either by direct statement or implication, treat them all as perennials. *Potamogeton Spirillus* under some conditions at least grows as an annual.

Department of Botany,
Cornell University

Our Varieties of Trifolium pratense.—It is generally assumed that the common Red Clover of cultivated fields and roadsides, where it has spread from the cultivated crops, is true *Trifolium pratense* L. A much less common plant of waste ground, roadsides and clearings from Labrador across the continent to Alaska and locally south through much of the United States is true *T. pratense*, the cultivated plant being var. *sativum* (Mill.) Schreb. The two are distinguished as follows:

T. pratense L. (typical). Short-lived perennial, with glabrous or sparingly pilose stems 0.5–4 dm. high; larger leaflets 1–3 cm. long and 0.5–1.5 cm. broad; heads 1.3–3 cm. long.

Var. sativum (Mill.) Schreb. Coarser and longer-lived, with stems 3–8 dm. high; larger leaflets 3–7 cm. long and 1.5–3.5 cm. broad; heads 3–4 cm. long.

A form of typical *T. pratense* with densely villous or hirsute stem is forma *pilosum* (Gris.) Hayek. The albino of typical *T. pratense* is forma *leucochraceum* Asch. & Prantl. The albino of var. *sativum* is forma *flavicans* (Vis.) Hayek.—M. L. Fernald.

Trifolium hybridum and its Var. elegans.—Two rather clearly defined extremes of *Trifolium hybridum* L. are naturalized in North America. Typical *T. hybridum* (*T. fistulosum* Gilib.) is the cultivated plant, spreading to roadsides and clearings. It is more frequently represented in the wild by var. *elegans* (Savi) Boiss., the latter widely naturalized but not generally cultivated. Typical *T. hydridum* has the hollow and soft stems 3–8 dm. high; the larger leaflets 2.5–6 cm. long and 2–3.5 cm. broad; the heads very dense and 2–3.5 cm. in diameter, the individual flowers being 8–11 mm. long. Var. *elegans* has the slender stems firmer, 1.5–6 dm. high; larger leaflets 1.5–3.5 cm. long and 1–2.5 cm. broad; the less compact heads 1.5–2.5 cm. in diameter, with the individual flowers only 6–8 mm. long.—M. L. Fernald.

Centaurea nervosa in America.—In studying the complex group including *Centaurea Jacea* L., *C. nigra* L. and *C. nigrescens* Willd. one sheet of material in the Gray Herbarium is quickly withdrawn from this intricate series. This is a specimen, in

foliage resembling *C. nigrescens*, but with the middle and outer phyllaries pale and tipped by a filiform and arched-recurving appendage bordered by similarly filiform and distant fringing cilia. The plant, which closely matches the European *C. nervosa* Willd., was collected at the margin of a grainfield east of the lower falls of North Beaver Creek, Vaughan's, Washington County, New York, July 30, 1916, by *Stewart H. Burnham*. It was distributed as *C. Jacea*, var. *nigra*. This seems to be the first evidence of *C. nervosa* in America. It is important to know whether in 28 years it has become established.—M. L. Fernald.

Volume 45, no. 535, including pages 265–304 and plates 762–769, was issued 6 July, 1943.

SEP 17 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. September, 1943. No. 537.

CONTENTS:

Sino-Himalayan Species of Shortia and Berneuxia. *Hui-Lin Li.* 333

Taraxacum in Arctic Canada (east of 100° W). *Gustaf Haglund* (Introduction by *Artheme Dutilly*). 337

Genus Aster in Nova Scotia. *L. H. Shinners.* 344

New Species of Haplopappus from Southwestern Texas. *U. T. Waterfall.* 351

Minor Transfers and Forms in Cirsium. *M. L. Fernald.* 353

New Form of Prunus virginiana from Indiana and Illinois. *George Neville Jones.* 354

Our Albino Lupine. *M. L. Fernald.* 356

Eastern Extension of Cirsium Flodmani. *M. L. Fernald.* 356

The New England Botanical Club, Inc.

8 and 10 West King St., Lancaster, Pa.

Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. September, 1943. No. 537.

ON THE SINO-HIMALAYAN SPECIES OF SHORTIA[1] AND BERNEUXIA

Hui-Lin Li

Ever since the days of Asa Gray, the genus *Shortia* has been of interest to students of phytogeography[2]. Up to the present, the species of this genus and its close relative *Berneuxia* are known from three isolated regions: eastern North America, Japan and Formosa, and southwestern China (Yunnan, Szechuan, and eastern Tibet). It is with the genera in the last-named region that this paper primarily deals.

Decaisne, in 1873, was the first to describe a species of this alliance from the Sino-Himalayan region, as *Berneuxia thibetica*. In 1888, Franchet transferred *Berneuxia thibetica* to *Shortia*. He apparently thought the similarities between this species and *Shortia* indicated generic identity. After a careful study of available specimens of these two genera, I conclude that Franchet's idea cannot be accepted. With the inclusion of *Berneuxia yunnanensis*, here published as new, species of this genus now number two, the older one being the original species of Decaisne.

In *Shortia* there are several species, only one of which, *Shortia sinensis* Hemsley (1901), which is evidently closer to the Ameri-

[1] *Shortia* Torr. & Gray (1842) was actually invalidated by *Shortia* Raf. (1840), and because of this House in 1908 replaced the former by the generic name *Sherwoodia* House. However, *Shortia* Torr. & Gray has been conserved by the special committee authorized by the last International Botanical Congress to act on matters of conservation, and *Sherwoodia* House was rejected; see Kew Bull. **1940**: 118. 1940.

[2] For an interesting summary of the early history of this genus see Jenkens, C. F., Asa Gray and his quest for Shortia galacifolia. Arnoldia 2: 13–28. *pl.* 4–7. 1942.

can and Japanese species known at that time than to the other Chinese species just mentioned, is found in the Sino-Himalayan region.

The several species described from Formosa are unfortunately not represented in our herbaria; thus a monographic study of the whole group cannot be undertaken. It is fortunate, however, that many of the species described in these two genera are illustrated by excellent plates.

The American *Shortia galacifolia* Torr. & Gray, the Japanese *S. uniflora* Maxim., and the Chinese *S. sinensis* Hemsley resemble each other in the dentate leaves, one-flowered peduncles, crenate corolla-lobes, and in the stamens and staminodes being arranged in two distinct whorls, the staminodes being inserted below the stamens near the base of the corolla-tube. Widely dispersed as they are, these three species are close enough in their general characters to be put into one subgroup of the genus *Shortia*. The Chinese species, *Shortia sinensis* Hemsley, has oblong-ovate leaves, which differ in shape from those of the other two species mentioned and are closer in this regard to those of the two species of *Berneuxia*, which otherwise is very different.

The several Japanese species originally described under *Schizocodon* Sieb. & Zucc., a genus which was included in *Shortia* by Otto Kuntze and most succeeding authors, may constitute another subgroup under *Shortia*. In the herbaria studied, *Shortia soldanelloides* (Sieb. & Zucc.) Mak. (*Schizocodon soldanelloides* Sieb. & Zucc.) and **Shortia ilicifolia** (Maxim.) comb. nov. (*Schizocodon ilicifolius* Maxim. Bull. Acad. Sci. St. Pétersb. **12:** 71. 1868, *Shortia soldanelloides* β *ilicifolia* Mak. Bot. Mag. Tokyo **15:** 150. 1901) are represented. They resemble the species of the group above-mentioned in the dentate leaves, crenate corolla-lobes, and distinct stamens and staminodes, but differ in having the many-flowered peduncles, the flowers spicately arranged, and the staminodes inserted only slightly below the stamens and bearing abortive anthers.

The Formosan species, *Shortia exappendiculata* Hayata, *S. subcordata* Hayata, *S. ritoensis* Hayata, and *S. transalpina* Hayata, which have also been placed in the Section *Exappendiculata* of *Shortia* as well as treated as a separate genus, *Shortiopsis*, by Hayata, are similar to the preceding group except that their

anthers are sessile, their styles undivided, and staminodes absent. These three groups are close enough in their combined vegetative and flowering characters, in my opinion, to be included in the same genus, *Shortia*.

Berneuxia is found only in the Sino-Himalayan region. The inflorescence is many-flowered like that of some of the species of *Shortia*, but here the flowers are more numerous and tend to be umbellately or subumbellately instead of spicately arranged. *Berneuxia* also differs from *Shortia* in that both the leaves and the corolla-lobes are entire and the stamens and staminodes are united into a ring, which is inserted near the base of the rather short corolla-tube. The corolla and stamens are not known for the new species of *Berneuxia* here described, but in other general characters this species conforms with the characters of the genus. It may be mentioned that Drude, in Engl. & Prantl, Nat. Pflanzenfam. **4**(1): 83–84. 1879, and Diels, in Bot. Jahrb. **50:** Suppl. 304–339. 1914, retained both *Schizocodon* and *Berneuxia* as generically distinct from *Shortia*. In my opinion, *Schizocodon* is congeneric with *Shortia*, but *Berneuxia* is sufficiently characterized to be considered as a distinct genus.

An enumeration of the species of *Shortia* and *Berneuxia* of the Sino-Himalayan region is given below. The specimens cited are deposited in the Gray Herbarium. This study was made possible through a grant from the Milton Fund of Harvard University to Dr. E. D. Merrill, of the Arnold Arboretum, to assist him in working up the extensive collections of botanical material received within the past few years from various parts of China.

SHORTIA SINENSIS Hemsley in Hook. Ic. Pl. **27:** *t. 2624*. 1901. *Sherwoodia sinensis* House, Torreya **7:** 233. 1907.—CHINA: Yunnan: Mengtze, southeastern mountains, *A. Henry 11490* (type coll.; not seen).

This species is apparently known only from the original collection. No isotype has been located in American herbaria.

BERNEUXIA THIBETICA Decaisne, Bull. Soc. Bot. France **20:** 159. 1873. *Shortia thibetica* Franch. Nouv. Arch. Mus. Nat. Paris II. **10:** 54. *t. 13 B*. 1887, Pl. David. **2:** 92. *t. 13 B*. 1888. *Shortia Davidi* Franch. op. cit. *t. 13 B*.—CHINA: Szechuan: without precise locality, *A. Henry 7976;* Pien-shen Hsien, *F. T. Wang 22774*, April 25, 1931, herb in thickets, alt. 2300 m., fl. white; west of Kuan Hsien, *F. T. Wang 2086*, May 1930, herb,

on grassy slopes, alt. above 3500 m., fl. white; O-pien Hsien, *T. T. Yü 648*, May 5, 1932, herb, in woods, leaves bright green above, white beneath, fl. white. Sikang: near Tachienlu, *A. E. Pratt 749*, at 9000–13500 feet. Yunnan: mountains above Tseku and Tseh-chung, Mekong-Salwin watershed, *J. F. Rock 8795*, May 19, 1923, on boulders; Mekong-Salwin Divide, Bila, *T. T. Yü 19031*, June 13, 1938, a perennial herb, 2–4 ins., upon precipitous rocks, alt. 3700 m., fl. white, common; Salwin-Kiukiang Divide, Swagchiang, *T. T. Yü 22968*, Nov. 5, 1938, herb, rare, in bamboo thickets, alt. 2800 m., fruit grayish brown; northwestern Likiang, Lutien, *R. C. Ching 20544*, May 29, 1939, plant 6 in. high, in mixed forests, fl. white; northwestern Likiang, Tse-ku on the Yangtze bank, *R. C. Ching 20589*, June 1, 1939, plant 6 in. high, in mixed forests, fl. white. Also known from eastern Tibet (Decaisne l. c.), and western Szechuan (Hand.-Maz. Symb. Sin. 7: 801. 1936).

BERNEUXIA **yunnanensis** sp. nov. Herba perennis subacaulis ubique glabra, caudice incrassato; foliis coriaceis glabris ovatis longe petiolatis, absque petiolo ad 3.2 cm. longis, 1.7 cm. latis, apice late obtusis, basi cuneatis, margine integris revolutis, supra virescentibus, subtus pallidioribus, nervis lateralibus utrinsecus 4, venis tertiariis supra leviter impressis subtus subconspicuis; petiolis alatis, ad 3 cm. longis; inflorescentiis gracilibus longe pedunculatis, ad 18 cm. longis, circiter 10–15-floris, floribus spicatis, superioribus subumbellatis, pedicellis hirtellis, 0.6–1.2 cm. longis, basi bracteatis, bracteis oblongis acuminatis circiter 5 mm. longis persistentibus, bracteolis 1 vel 2 medium pedicelli versus, lanceolatis acuminatis circiter 4 mm. longis, persistentibus; calyce 5-partito, lobis fere liberis ovatis, 4–5 mm. longis, 2.5 mm. latis, rigidis scariosis longitudinaliter striatis persistentibus; corolla staminibusque non visis; ovario triloculari multiovulato, stylo persistente 1 mm. longo, stigmate distincte 3-lobato.—CHINA: Yunnan: Salwin-Kiukiang Divide, Natahtzu, *T. T. Yü 20803* (TYPE), Oct. 20, 1938, a casual, perennial herb, alt. 3600 m., under trees or upon shaded rocks, fruit purplish red, calyx persistent.

This species is a close relative of *Berneuxia thibetica* Dec., differing in the smaller leaves with shorter petioles and relatively broader blades. These are always ovate, with a more or less broadly obtuse apex, while in *B. thibetica* the leaves are usually oblong-obovate, and with an obtuse to acute or acuminate apex. The inflorescence of the new species is more or less spicate, with the uppermost flowers somewhat umbellately arranged; in *B. thibetica* the flowers are definitely umbellate. Moreover, in the latter species the peduncle equals or only slightly exceeds the

length of the leaves, while in the new species it is about three times as long as the leaves.

All the specimens on the two available sheets of the type collection are rather mature, approaching fruiting condition and without corollas and stamens. In the field note, it is mentioned that the collection included a flowering specimen (*T. T. Yü 19384*), but no flowers are present in our material. As the characters on the material at hand are sufficient to indicate that a new species is represented, and since there is little prospect of receiving any further shipments of specimens from China in the near future, it appears desirable to name and describe the plant without further delay.

Arnold Arboretum,
Harvard University.

TARAXACUM IN ARCTIC CANADA (EAST OF 100° W.)

Gustaf Haglund

(Introduction by Artheme Dutilly, O. M. I.)

In the course of my first seven successive botanizing trips to the Canadian Arctic, I collected a number of specimens of *TARAXACUM*. In 1938 I was accompanied by Rev. Maximilian Duman, O.S.B., who also collected a few in the same region.

A synopsis of the localities, dates of collections, and collection numbers, follows:

1—Arctic Alaska
2—Arctic Bay, Baffin Isl., N. W. T., Lat. 73° 5′ N., Long. 83° 40′ W., Silurian-Lower Palaeozoic, 12–9–36.
3—Baker Lake, N. W. T., Lat. 64° 30′ N., Long. 97° ?′ W., Archaean, 11–8–36, 2–9–37, 31–7–38.
4—Bernard Harbor, Lat. 68° 46′ N., Long. 114° 50′ W., 20–8–34.
5—Cape Barrow, Arctic Sea, Alaska.
6—Cape Dorset, Baffin Island, N. W. T., Lat. 64° N., Long. 76° W., Archaean and (?) precambrian granite, gneiss, 25–8–36.
7—Chesterfield Inlet, Hudson Bay, N. W. T., Lat. 63° 20′ N., Long. 90° 42′ W., Archaean, 31–7–36, 21–8–37, 16–8–28.
8—Churchill, Man., Hudson Bay, N. W. T., Lat. 58° 46′ N., Long. 94° 10′ W., Lower Palaeozoic, 23–7–36, 8–8–38.

9—Fort Smith, Mackenzie River, N. W. T., Lat. 60° ?′ N., Long. 111° 55′ W., Alluvial, 26–6–40.
10—Great Whale River, Ungava, Quebec, Lat. 55° 26′ N., Long. 78° 46′ W., Archaean, granite, 14–9–39.
11—Ivuyivik, Ungava, Quebec, Lat. 62° 25′ N., Long. 78° 5′ W., Precambrian, granite, and gneiss, 23–7–38, 23–8–39.
12—King William Island, N. W. T.
13—Lake Harbour, Baffin Island, N. W. T., Lat. 62° 50′ N., Long. 69° 55′ W., Precambrian granite and gneiss, 27–8–36, 28–8–41.
14—Letty Harbour, Arctic Sea, N. W. T., Lat. 70° ?′ N., Long. 124° ?′ W., Pleistocene and ?, 19–7–40.
15—Port Burwell (Labrador), N. W. T., Lat. 60° 25′ N., Long. 64° 52′ W., Precambrian, volcanics and intrusives, 1–9–41.
16—Repulse Bay, North Hudson Bay, N. W. T., Lat. 66° 33′ N., Long. 86° 40′ W., Archaean, 10–9–37, 20–8–38, 11–9–38.
17—Signuia (Cape Haven), Baffin Island, N. W. T.
18—Sugluk Bay, Ungava, Quebec, Lat. 62° 15′ N., Long. 75° 28′ W., Archaean, 13–9–38.
19—Wakeham Bay, Ungava, Quebec, Lat. 61° 36′ N., Long. 72° ?′ W., Precambrian, granite and gneiss, 19–8–39.
20—Wolstenholme, Ungava, Quebec, Lat. 62° 25′ N., Long. 77° 14′ W., Precambrian, volcanics and intrusives, 24–8–36.

This list includes data for specimens by other collectors cited by Haglund.

Most of the localities just listed are shown on the map of the Northwest Territories published by the Canadian Department of the Interior (scale 60 miles to 1 inch), Ottawa, 1929.

At the suggestion of Prof. Eric Hultén of the Universitet, Lund, Sweden, on his visit to Washington a few years ago, the collections were sent to Dr. Gustaf Haglund, Lund, Sweden, who has prepared the following treatment.

KEY

A. Outer phyllaries corniculate-appendaged beneath the apex.
  B. Outer phyllaries broad, short to more or less broad-ovate. Appendages small. Flowers white or yellow. Achenes black to greenish black.
    c. Flowers white. Achenes black. . . . . 1. *T. hyparcticum* Dahlst.
    c. Flowers yellow. Achenes greenish black.
      d. Leaves entire to sparingly lobed. . . . . 2. *T. phymatocarpum* J. Vahl.
      d. Leaves densely lobed. Lobes deltoid, more or less dentate. . . . . 3. *T. alaskanum* Rydb.
B. Outer phyllaries mostly narrower and longer, more or less ovate-lanceolate to lanceolate, rarely with short, mostly with long to very long appendages beneath the apex. Flowers yellow. Achenes sordid or greenish straw-colored to more or less reddish to reddish brown.
  c. Achenes sordid to greenish straw-colored.
    d. Lobes of the leaves more or less long, more or less narrow. Petioles usually bright violet-red. . . . . 4. *T. lacerum* Greene.

d. Lobes of the leaves broader, deltoid. Petioles pale. . . . . 5. *T. hyperboreum* Dahlst.

c. Achenes more or less red to reddish brown (umbra-brown).

d. Achenes more or less red with a narrow, cylindrical beak. . . . . 6. *T. Malteanum* Dahlst.

d. Achenes reddish brown to umbra-brown with a more or less short, conical beak.

e. Terminal lobes of the leaves mostly more or less short (triangular).

f. Leaves long, narrow, lobes short, triangular, more or less remote with sharp points. . . . . 7. *T. pseudonorvegicum* Dahlst.

f. Leaves shorter, lobes broader, deltoid, more or less approximate, less acute. . . . . 8. *T. russeolum* Dahlst.

e. Terminal lobes of the leaves mostly very long and narrow. . . . . 9. *T. umbrinum* Dahlst.

A. Outer phyllaries lacking appendages.

B. Achenes straw-yellow with a conic-cylindrical beak about 1 mm. long. . . . . 10. *T. lapponicum* Kihlm.

B. Achenes light brown with a hardly conspicuous or a very short, conical beak. . . . . 11. *T. dentifolium* G. Hagl.

1. Taraxacum hyparcticum Dahlst. Arkiv. f. Bot. **4**[8]: 17. 1905.—"*T. phymatocarpum* Handel-Mazzetti" Mon. Gat. Tarax. 58. 1907, pro parte.—Baffin Island: *Dutilly* 1385. Arctic Bay.

2. T. phymatocarpum J. Vahl in Hornem. Icones Fl. Dan. **12**[39]: 6. t. 2298. 1840; H. Dahlstedt Arkiv f. Bot. **4**[8]: 22. 1905; Handel-Mazzetti Mon. Gat. Tarax. 58. 1907, pro parte.—Northwest Territory: *Dutilly* 393, Letty Harbour.

3. T. alaskanum Rydb. Bull. Torr. Bot. Club. **28**: 512. 1901. *T. pumilum* Dahlst. Arkiv. f. Bot. **4**[8]: 27. 1905.—Arctic Alaska and eastern Arctic America.

4. T. lacerum Greene, Pittonia **4**: 230. 1901. *T. groenlandicum* Dahlst. Arkiv. f. Bot. **5**[9]: 23. 1906. Quebec: *Dutilly* 4062. Ungava, Wakeham Bay.—Manitoba: *J. M. Macoun* 79286, Hudson Bay, Churchill; *Duman* 1149, 1534, 1938, Churchill; *Dutilly* 143, Churchill.—Northwest Territories: *Dutilly* 6601 i, Chesterfield Inlet; *Dutilly* 152, Fort Smith.

5. T. hyperboreum Dahlst. in Ostenfeld, Vid. Selsk. Skr. Math. Nat. **8**: 26. 1909.—King William Land: *Frits Johansen* 98714, Bernard Harbour.

6. T. **Malteanum** Dahlst. n. sp. *Folia* sat obscure viridia ± linearia-lineari-lanceolata, lobis brevibus ± deltoideis-triangularibus basi sat latis acutis apice brevi haud raro paullum recurvato dorso integro vel in foliis interioribus parce denticulato, lobo terminali triangulari-hastato-sagittato brevi vel in foliis interioribus paullum elongato acuto lobulis basalibus brevibus acutis, petiolis et nervis medianis pallidis. *Scapi* folia superantes ± colorati glabri vel apice ipso leviter araneosi. *Involucrum* mediocre ± atro-viride basi ovata. *Squamae* exteriores ± ovato-

lanceolatae sub apice breviter cornutae-corniculatae laxe adpressae vix marginatae, interiores sub apice ± cornutae. *Calathium* 25–35 mm. diametro. *Ligulae* obscure luteae, marginales extus stria fusco-violacea ornatae. *Antherae* polline carentes. *Stylus* et *stigmata* atro-viridia. *Achenium* ± rubiginosum, 4 mm. longum c. 1 mm. latum apice breviter spinulosum ceterum ± tuberculatum in pyramiden 1–1.2 mm. longam fere cylindricam sat abrupte abiens. *Rostrum* 10 mm. longum. *Pappus* albus 6–8 mm. longus.—Northern Quebec, North-West Territories and Baffin Island. QUEBEC: *Dutilly* 899, Wolstenholme; *Dutilly* 1938, 6057, 6058, Wakeham Bay; *Dutilly* 6100b, 6101a, Ivuyivik. NORTH-WEST TERRITORIES: *Dutilly* 6800, Repulse Bay; *J. R. Cox. J. J. O'Neill* 98712, South Coast of Coronation Gulf, Cape Barrow. BAFFIN ISLAND: *M. O. Malte* 120293, Lake Harbour. (TYPE in State Museum of Natural History, Stockholm).

The species simulates in habit certain modifications of *T. pseudonorvegicum* Dahlst., but is clearly distinct by its dark-green leaves having triangular to deltoid, short lobes, broad at the base, with slightly downward-turned points and usually short terminal lobe. The achenes are rust-red to rust-brown with a cylindrical, comparatively long and narrow beak recalling those of the group *Erythrosperma* Dahlst. The specimen from Point Barrow belongs to an entire-leaved modification, in what concerns the phyllaries and the achenes completely agreeing with those from Lake Harbour.

7. T. **pseudonorvegicum** Dahlst. n. sp. *Folia* gramineo-viridia elongata anguste linearia-lineari-lanceolata sat distantia, lobis brevibus triangularibus basi latis integris apicibus patentibus acutis-longioribus dorso parce dentato apicibus magis protractis ± retroversis acutis, lobo terminali angusto ± elongato lobulis basalibus perbrevibus ± patentibus acutis, petiolis et nervis medianis ± pallidis. *Involucrum* parvum-mediocre ± atro-viride et ± pruinosum basi ovata. *Squamae* exteriores ± late ovato-lanceolatae-ovales breviter acuminatae sub apice cornubus brevibus-mediocribus praeditae ± adpressae et conspicue albido-marginatae, interiores lineari-lanceolatae sub apice breviter cornutae-corniculatae. *Calathium* parvum 30–35 mm. diametro. *Ligulae* amoene luteae angustae ± canaliculatae, marginales extus stria angusta vel fere evanescenti cano-violacea notatae. *Antherae* polline carentes. *Stylus* et *stigmata* obscure fusco-virescentia, sicca ± atra. *Achenium* fulvo-brunneum 4 mm. longum c. 1.2 mm. latum apice ± longe et late spinulosum ceterum ± tuberculatum vel basi laeve in pyramiden vix 1 mm. longam vel breviorem conico-cylindricam abrupte abiens.

Rostrum 7–8 mm. longum. *Pappus* albus 5–7 mm. longus.—Baffin Island and North-West Territories. BAFFIN ISLAND: *D. White* et *Ch. Schuchert* 110, Signuia, near Cape Haven; *J. Dervey Soper* 121112, Cape Dorset; *N. Polunin* 2190, Cape Dorset. NORTH-WEST TERRITORIES: *M. O. Malte* 120448, Chesterfield Inlet, Hudson Bay, (TYPE in the State Museum of Natural History, Stockholm); *Dutilly* 4454, 6623, 6715, Chesterfield Inlet; *Dutilly* 6298h, Baker Lake.

The species is apparently related to *T. umbrinum* Dahlst., but is well distinguished from that species by its shorter, more patent lobes of the leaves, longer and stronger developed appendages of the phyllaries, as it seems smaller heads and larger yellowish-brown achenes which have longer spines at the top and which abruptly pass into the beak and have a longer stipe of pappus. The lobes of the leaves often gives it a similarity with *T. norvegicum* Dahlst., from which it, however, clearly differs in shorter lobes of the leaves, broader at the base, pale petioles and median nerves, smaller heads, more narrow ligulae and achenes that are more pale-coloured and have a longer stipe of pappus.

8. T. **russeolum** Dahlst. n. sp. *Folia* laete viridia anguste lanceolata-oblongo-lanceolata paucilobata, lobis brevibus triangularibus-deltoideis basis ± latis apicibus brevibus patentibus vel saepe paullum recurvatis acutis, lobo terminali sat elongato triangulari-ovato-hastato marginibus convexis integris breviter acuto, interiora magis integra crebre lobulato-dentata apice integra breviter acuta, petiolis pallidis vel basi leviter coloratis et nervis medianis pallidis vel vulgo leviter coloratis. *Scapi* folia aequantes vel ± superantes ± colorati sub involucro ± araneosi. *Involucrum* sat obscure olivaceo-viride basi ± ovata. *Squamae* exteriores ± ovatae-ovato-lanceolatae laxe adpressae-leviter patentes supra saepe ± violascentes acuminatae ecorniculatae vel singulae-interdum fere omnes ± corniculatae-cornutae, interiores sub apice breviter corniculatae vel callosae. *Calathium* 30–35 mm. latum. *Ligulae* luteae, marginales extus stria rubro-purpurea notatae. *Antherae* polline carentes. *Stylus* et *stigmata* sat fusco-virescentia, sicca sat obscura. *Achenium* laete rubiginosum apice breviter spinulosum ceterum ± tuberculatum c. 4 mm. longum 1 mm. latum vel paullo latius apice in pyramiden 0.8 mm. longam late conicam sensim abiens. *Rostrum* c. 8 mm. longum. *Pappus* albus c. 7 mm. longus.—BAFFIN ISLAND: *M. O. Malte* 119207, Lake Harbour (TYPE in State Museum of Natural History, Stockholm; *Dutilly* 1040a (*T. russeolum ?*), Lake Harbour.

Distinguished from other here described types of the group

Ceratophora Dahlst. by the following characteristics. The leaves are broader, especially towards the apex. They have fewer, short and broad lobes with short somewhat downward turned sharp points. The petioles as well as the median nerves are often slightly colored. The phyllaries are more light-colored with more or less broad, acuminate outer phyllaries which have or have not more or less strongly developed appendages below the apex. The appendages of the inner phyllaries are very short. The achenes are more or less rust-red with very short and broad, conical beaks. The outer phyllaries are subject to a considerable variation concerning appendages. In some specimens these are completely lacking or can just be traced on the outer phyllaries while in others they are lacking on part of the phyllaries but more or less well developed on others. In several specimens they are found in some heads but are lacking in others. The inner phyllaries always possess appendages, even if they sometimes are very small.

9. T. **umbrinum** Dahlst. n. sp. *Folia* gramineo-viridia linearia-lineari-lanceolata parce lobata, lobis brevibus-brevissimis triangularibus basi latis parce denticulatis apicibus patentibus vel longioribus recurvis acutis, lobo terminali ± elongate triangulari obtuso-acutiusculo, petiolis angustis et nervis medianis pallidis. *Scapi* plures folia ± superantes vel aequantes ± colorati ± glabri. *Involucrum* mediocre latum crassiusculum ± atro-viride basi ovato-truncata. *Squamae* exteriores latiusculae ovatae-ovato-lanceolatae subadpressae parum vel vix marginatae plurimae sub apice breviter acuminato corniculis obtusis plerumque sat parvis praeditae, interiores corniculatae vel callosae. *Calathium* c. 40 (–45) mm. diametro. *Ligulae* subobscure luteae, marginales extus stria rubro-violacea ornatae. *Antherae* polline carentes. *Stylus* et *stigmata* fusco-virescentia, sicca sat obscura. *Achenium* umbrinum apice breviter spinulosum ceterum ± tuberculatum vel laeve angustum c. 3.5 mm. longum 0.75 mm. latum in pyramiden vix 1 mm. longam conico-cylindricam sensim abiens. *Rostrum* 6–7 mm. longum. *Pappus* albus 6–7 mm. longus. Northern Labrador, Northern Quebec and Baffin Island.

LABRADOR: *M. O. Malte* (TYPE in State Museum of Natural History, Stockholm), Hudson Strait, Port Burwell; *Dutilly* 1657b, Hudson Strait, Port Burwell.

QUEBEC: *Dutilly* 6984 f, h, j, k, Sugluk West; *M. Duman* 2494, Sugluk West; *Dutilly* 810a, 900 (T. cfr. umbrinum), Wolstenholme; *Dutilly* 6100a, 6101b, Ivuyivik. BAFFIN ISLAND: *Dutilly* 1355, Arctic Bay.

This species with its weakly developed appendages on the phyllaries belongs to the less differentiated types in the group *Ceratophora* Dahlst. The appendages that usually are inconsiderable are best developed on the outer phyllaries. Often, especially on the inner phyllaries, they are only indicated by a small swelling under their points. In its pure white, silky pappus-bristles it completely agrees with other species of the group. The achenes are characteristic, have umbra-brown colour with weakly developed spines at the apex but are otherwise tuberculate to more or less glabrous and are gradually merging into the hardly one mm. long beaks. The stipe of pappus is unusually short. This species comes closest to *T. norvegicum* Dahlst. of the European species.

10. T. LAPPONICUM Kihlm. Meddel. Soc. Faun. Fl. Fenn. **11:** 108. 1884. *T. croceum* Dahlst. in Anderss. and Hesselman Bih. K. Svenska Vet.-Akad. Handl. **26,** Avd. 3. 1900; Handel-Mazzetti Mon. Gat. Tarax. 73. 1907, pro parte.—LABRADOR: *Dutilly* 1657a, Port Burwell. QUEBEC: *Dutilly* 6047m, Wakeham Bay; *A. P. Low* 63228, Great Whale River.

11. T. **dentifolium** G. Hagl. n. sp. *Planta* parva-mediocris sat robusta. *Folia* lobis lateralibus deltoideis approximatis brevibus latis retroversis dorso saepius ± dentato. *Achenium* c. 4 mm. longum laete brunneum superne squamulosum-spinulosum ceterum pro maxima parte laeve sat sine pyramide vel pyramide brevissima late conica. Ceterum *T. lapponico* Kihlm. simile.—QUEBEC: *Dutilly* 6074f, h, Wakeham Bay; *Duman* 2652, (TYPE in Herbarium Catholic University of America, Washington, D. C.), Wakeham Bay.

This species is closely related to *T. lapponicum* Kihlm. but differs by its light brown achenes rather lacking beaks or with very short, broad conical ones. The lobes of the leaves are approximate, broad and short with downwards turned, acute points. They are often more or less dentate in their upper margins.

Contribution from the UNIVERSITY OF LUND and the ARCTIC INSTITUTE OF THE CATHOLIC UNIVERSITY OF AMERICA.

THE GENUS ASTER IN NOVA SCOTIA

L. H. SHINNERS

THIS is a synopsis of the species of *Aster* known to occur in Nova Scotia, based chiefly on a study of collections in the Herbarium of Nova Scotia Agricultural College, the Herbarium of the University of Wisconsin, and the Gray Herbarium. Notes on distribution and habitat have been obtained from information given on specimen labels, supplemented by published records, and by field notes supplied by Mr. A. E. Roland, of Nova Scotia Agricultural College, Truro. No effort has been made to give full discussions of minor forms and hybrids, and of nomenclature, or to account for all published reports of species which are not included in the present list. Press of other work and of other circumstances have made it necessary to complete this study more hurriedly and less thoroughly than was desired, but it is hoped that it will prove helpful to those studying the flora of eastern Canada.

For much invaluable assistance and for many courtesies, I am indebted to Mr. Roland, and to Mr. C. A. Weatherby, of the Gray Herbarium. Grateful acknowledgment is made to the curators of the herbaria listed above for the use of collections in their charge.

In the following key and descriptions, the height of the involucre is given as measured from the base to the tips of the inner phyllaries; in *A. Rolandii*, *A. foliaceus*, and *A. puniceus*, the outer phyllaries may be longer.

KEY TO NOVA SCOTIA SPECIES OF ASTER

1. Middle and lower stem-leaves petioled, the blades abruptly narrowed or truncate or cordate at base
   2. Outermost phyllaries (involucral bracts) 1.0–2.5 mm. wide, less than 2½ times as long as wide . . . . . 1. *A. macrophyllus*
   2. Outermost phyllaries 0.2–0.8 mm. wide, more than 2½ times as long as wide
      3. Phyllaries glabrous on the back
         4. Involucres 5.2–8.2 mm. high; disks 4.5–7.5 mm. across; inflorescence corymbose-paniculate, the peduncles or ultimate branches very uneven in size . . . . . 3. *A. ciliolatus*
         4. Involucres 3.6–5.2 mm. high; disks 3–5 mm. across; inflorescence racemose-paniculate, the peduncles equal or grading uniformly in size . . . . . 4. *A. cordifolius*
      3. Phyllaries pubescent on the back . . . . . 5. *A. undulatus*

1. Middle and lower stem-leaves sessile, or tapering gradually to slender petiole-like bases
   5. Middle phyllaries with midveins expanded upward into prominent colored (usually green) tips
      6. Phyllaries glabrous on the back
         7. Involucres 3.3–6.0 mm. high; outer phyllaries 0.3–3.3 mm. long, not more than ⅔ as long as the inner
            8. Rays 3.5–6.0 mm. long; leafy bracts of the peduncles and ultimate branches of the inflorescence oblong-lanceolate or narrowly oblong, acute or obtuse
               9. Leaves pubescent on the midvein beneath, at least toward the base ..... 6. *A. lateriflorus*
               9. Leaves glabrous beneath
                  10. Involucres 4.8–6.0 mm. high; stems glabrous or more commonly pubescent; plants of Cape Breton Island ..... 7. *A. tenuipes*
                  10. Involucres 3.3–5.0 mm. high; stems glabrous; plants of southwestern Nova Scotia ... 8. *A. Tradescanti*
            8. Rays 5.5–10 mm. long; leafy bracts of the peduncles and ultimate branches of the inflorescence linear-lanceolate, acuminate ..... 9. *A. paniculatus*
         7. Involucres 5–12 mm. high; outer phyllaries 3–12 mm. or more long, more than ⅔ as long as the inner
            11. Stems glabrous or pubescent above in lines
               12. Internodes just below the inflorescence 4–16 mm. long; plants 8–50 cm. tall; involucres 5–8 mm. high ..... 10. *A. Rolandii*
               12. Internodes just below the inflorescence 16–45 mm. long; plants 30–110 cm. tall; involucres 6–9 mm. high ..... 11. *A. foliaceus*
            11. Stems hispid-pubescent over the surface ..... 12. *A. puniceus*
      6. Phyllaries glandular or pubescent or both on the back
         13. Involucres less than 6 mm. high ..... 5. *A. undulatus*
         13. Involucres more than 6 mm. high ..... 13. *A. novae-angliae*
   5. Middle phyllaries without colored tips, or with colored tips not formed by the expansion of the midveins
      14. Involucres more than 6 mm. high
         15. Outer phyllaries 1.0–2.5 mm. wide ..... 2. *A. radula*
         15. Outer phyllaries 0.2–0.8 mm. wide
            16. Largest stem-leaves 3–12 mm. wide; plants with 41–75 or more leaves below the inflorescence ..... 14. *A. nemoralis*
            16. Largest stem-leaves 9–50 mm. wide; plants with 10–40 leaves below the inflorescence
               17. Largest stem-leaves 9–24 mm. wide; plants with 25–40 leaves below the inflorescence ..... × *A. Blakei*
               17. Largest stem-leaves 20–50 mm. wide; plants with 10–20 leaves below the inflorescence .... 15. *A. acuminatus*
      14. Involucres less than 6 mm. high ..... 16. *A. umbellatus*

I. Macrophyllus Series

Involucres large (6.5–12 mm. high); phyllaries broad, obtuse or acute, with colored tips not formed by the expansion of midveins.

1. A. macrophyllus L. (Including var. *velutinus* Burgess.) Woods and thickets, less commonly in open ground; frequent,

chiefly in the central and western parts of the province, from Pictou Co. to Yarmouth Co.

2. A. RADULA Ait. (Including var. *strictus* (Pursh) Gray, at least as to plants of Nova Scotia.) Bogs, wet meadows, and damp thickets; common throughout the province.

II. CORDIFOLIUS SERIES

Involucres small or middle-sized (3.6–8.2 mm. high); phyllaries narrow, acute, with colored tips formed by the expansion of the midveins. Middle and lower stem-leaves petioled, the blades truncate or cordate at base.

3. A. CILIOLATUS Lindl. ex Hook., Fl. Bor.-Am. **2:** 9, 1834. *A. Lindleyanus* T. & G., Fl. N. A. **2:** 122, 1841. *A. Lindleyanus* var. *ciliolatus* A. Gray, Syn. Fl. N. A. **1:** 182, 1884.

Known from a single collection, the specimen not yet in flower but unmistakably this species: border of old hillside woods, Mt. Uniacke, Hants Co., *Fernald, Bartram & Long*, July 26, 1921 (in Gray Herbarium).

4. A. CORDIFOLIUS L. Thickets, roadsides, and open ground; common in the central and northern parts of the province, from Annapolis Co. to Cape Breton Island.

5. A. UNDULATUS L. Dry open woods and thickets; southern Lunenburg Co., and (according to Weatherby, 1942) at Greenfield in adjacent Queens Co.

III. LATERIFLORUS SERIES

Involucres small (3.3–6.0 mm. high); phyllaries narrow, obtuse or acute, with colored tips formed by the expansion of the midveins. Leaves sessile, linear-lanceolate to elliptic. Peduncles and branches bearing numerous leafy bracts of more or less uniform size.

6. A. LATERIFLORUS (L.) Britton. Dry open woods, thickets, fields, pastures, and roadsides; very common throughout the province.

7. A. **tenuipes** (Wieg.), stat. nov. *A. lateriflorus* var. *tenuipes* Wiegand, RHODORA **30:** 174, 1928.

Swamps and damp woods, Cape Breton Island.

With more diffuse inflorescence and fewer longer-peduncled heads than *A. lateriflorus*, and without the pubescent midveins of the leaves of that species, which it otherwise resembles in having the stem usually pubescent and the disk corollas deeply lobed. In general appearance much like *A. Tradescanti*. It seems desirable to indicate its peculiarities by according it recognition as a separate species, rather than retaining it as a variety under *A. lateriflorus*, where it is not at home.

8. A. TRADESCANTI L.; Fernald, RHODORA **35:** 312–314, 1935. *A. saxatilis* (Fernald) Blanchard; Wiegand, RHODORA **35:** 34, 1933.

Damp shores in the southern part of the province, in Digby, Yarmouth, and Queens Counties.

IV. PANICULATUS SERIES

Involucres rather small (4.0–5.5 mm. high); phyllaries narrow, acute, with green tips formed by the expansion of the midveins. Leaves sessile, narrowly lanceolate. Peduncles and branches bearing few scattered leafy bracts of uneven size.

9. A. PANICULATUS Lam., Encyc. **1:** 306, 1783; *sensu* Wiegand, RHODORA **35:** 28–29, 1933. Not *A. paniculatus* Mill., Gard. Dict., no. 24, 1768.

Damp thickets and marshy ground, Cape Breton Island; apparently not common.

The name *A. paniculatus* Lam., though illegitimate, is here retained as a temporary expedient, following the nomenclature used by Wiegand, pending a more complete investigation of the much involved and uncertain synonymy of the species.

V. FOLIACEUS SERIES

Involucres middle-sized to large (5–9 mm. high); middle phyllaries with green tips formed by the expansion of the midveins, outer phyllaries loose, more or less enlarged and foliaceous. Leaves glabrous, sessile, often very slightly clasping at base. Stems glabrous or pubescent in lines.

10. A. **Rolandii,** sp. nov. Species parva maritima littoralis, *A. foliaceo* affinis, sub nomine *A. novi-belgii* confusa: minor, caulis 8–50 cm. altus, internodi superiores 4–16 mm. longi; inflorescentia corymboso-paniculata; involucra 5–8 mm. alta, phyllariis exterioribus plus minusve foliaceis, longioribusque interioribus; ligulae 8–13 mm. longae, disci 8–12 mm. lati, pappus plus minusve tinctus. TYPE: Roadsides, Troy, Inverness Co., Nova Scotia, *A. R. Prince and C. E. Atwood 1456*, Sept. 26, 1928 (in Herb. Univ. of Wisconsin).

Perennial from extensively creeping and freely branching rootstocks, forming loose mats. Stems glabrous or pubescent in lines above, more or less striate or sulcate, varying in color from stramineous or light green through speckled to solid red-brown or red-purple. Branching normally above the middle, the inflorescence broad and more or less flat-topped. Leaves glabrous except for the scabrous margins, elliptic-lanceolate to linear-lanceolate, entire or sharply and shallowly serrate, dark green above, paler and prominently reticulate-veined beneath, 1-ribbed, often with

sterile axillary shoots. Branches and peduncles with scattered leafy bracts of uneven size, the upper much reduced. Involucres broadly turbinate or hemispherical, the outer phyllaries from slightly shorter to longer than the inner, loose or occasionally almost squarrose, acute, more or less foliaceous. Pappus gray or dingy yellow to light brown or rust-color.

Very common on sandy or gravelly beaches and in wet places along the coast, throughout Nova Scotia, including Sable Island. Found also along the coasts of Quebec, New Brunswick, and Prince Edward Island.

True *Aster novi-belgii* L., based on "Aster novae belgiae latifolius, umbellatus, floribus dilute violaceis" of Hermann's *Hortus Lugduno-Batavus*, and typified by plate 69 in that work (cf. Gray, 1882), is a much stouter plant than *A. Rolandii*, with the long internodes and tall stems of *A. foliaceus*, but the inflorescence racemose-paniculate, and the branches and peduncles with numerous rather uniform leafy bracts. The inflorescence is usually very large, often embracing more than half the plant. Judging from the rather scanty herbarium material seen, it ranges from Massachusetts to Pennsylvania and Virginia, probably in several varieties differing in leaf proportions, leaf texture, nature of the phyllaries and bracts of the peduncles (prevailingly strongly squarrose), and size of involucres. Some of the varieties recognized by Asa Gray (1884) were based on European garden plants of questionable identity, and perhaps should not be retained for the wild forms of North America. The application of all the names is in need of revision.

11. A. FOLIACEUS Lindl. *A. junceus* and *A. longifolius* of authors, in large part, especially as to plants of Nova Scotia.

Swamps and marshes, both along the coast and in the interior, common throughout the province.

Variable in leaf-proportions, number of heads, compactness of inflorescence, leafiness of phyllaries, and time of flowering. In some Quebec specimens the outer phyllaries are extremely large and leafy, suggesting the western *A. Cusickii;* these perhaps should receive recognition as a separate variety. Certain others with broad-based and more or less clasping leaves may represent hybrids with *A. puniceus*, and some with very narrow leaves suggest hybridization with *A. junciformis* Rydb., a species now known to extend eastward to Quebec (Anticosti) and New Brunswick. The whole group of *Aster foliaceus* is a complex one, whose

proper revision for eastern North America would entail a study of the numerous and difficult western forms of the species and its relatives. No attempt is made here to do more than assign the Nova Scotia plants to the proper species, without concern for varieties which it may be desirable to recognize at some later time.

As indicated in a previous paper (1941), *Aster junceus* Ait. was based on a mixture, and the name has been applied to a mixture containing one element which was not among those known to Aiton. No more satisfactory solution has resulted from the present study, and the name is therefore dropped altogether. *Aster longifolius* Lam. may be the same as *A. foliaceus* Lindl. Several specimens so named by Gray, after seeing the type, are *A. foliaceus*, but one is *A. paniculatus*. The description is insufficient for satisfactory identification. In view of the ever present possibility of hybridization, especially common in this group, it does not seem desirable to displace the well established *A. foliaceus* Lindl., a name fortunately based on wild plants collected in America.

VI. Puniceus Series

Involucres large (6–12 mm. high); middle phyllaries with green tips formed by the expansion of the midveins, outer phyllaries enlarged and foliaceous. Leaves scabrous, sessile and auriculate-clasping. Stems hispid-pubescent over the surface.

12. A PUNICEUS L. Swamps and wet open places; common throughout the province.

Some of the named varieties are probably to be referred to hybrids with *A. foliaceus* or other species, others are hardly more than forms of the species itself. For the present, no attempt is made to dispose of them individually.

VII. Novae-angliae Series

Involucres large (7–12 mm. high), glandular; rays very numerous. Leaves auriculate-clasping, rather short and crowded. Stems hispid-pubescent.

13. A. NOVAE-ANGLIAE L. Vicinity of Annapolis, Annapolis Co., and Woodburn, Pictou Co.; probably an escape from cultivation.

VIII. Nemoralis Series

Involucres rather large (6.3–9.0 mm.); midveins of the phyllaries not expanded upward. Rays long and conspicuous.

14. A. NEMORALIS Ait. Bogs and marshes, very common throughout the province.

× A. BLAKEI (Porter) House, N. Y. State Museum Bull. **219-220:** 241, 1919. *A. nemoralis* var. *Blakei* Porter, Bull. Torr. Bot. Club **21:** 311, July 20, 1894. *A. nemoralis* var. *major* Peck, N. Y. State Mus. Ann. Rept. **47** (1893): 155, 1894; not *Aster major* (Hook.) Porter (as *majus*), Mem. Torr. Bot. Club **5:** 325, 1894. (*A. acuminatus* × *A. nemoralis.*)

Borders of woods and thickets, in damp or rather dry ground; rather common in the southern and eastern parts of the province.

In Nova Scotia, *Aster Blakei* is most common in sections where one supposed parent, *A. acuminatus*, is rare or unknown. This does not necessarily rule out the possibility of hybridization in the past as an explanation for the origin of *A. Blakei*, but does indicate the desirability of further investigation. It is unusually common and uniform for a hybrid *Aster*, but the parents belong to a group separate from the common eastern Asters, and it is to be expected that hybrids between them might behave differently from those of the true Asters. In view of the intermediate characters of *A. Blakei*, both morphological and ecological, House's conclusion that it is a hybrid seems entirely reasonable. In general appearance it resembles *A. nemoralis* more than *A. acuminatus*, but as shown in the key, it is about as close to one as to the other in the two most useful diagnostic characters.

15. A. ACUMINATUS Michx. Deciduous woodlands and thickets, preferring drier soils; common in the northwestern part of the province, very uncommon elsewhere.

X. UMBELLATUS SERIES

Involucres small (3.0–4.6 mm. high); midveins of the phyllaries not expanded upward. Inflorescence flat-topped.

16. A. UMBELLATUS Mill. Swamps, damp thickets, and marshy ground; common throughout the province.

REFERENCES

Fernald, M. L. 1922a. The Gray Herbarium Expedition to Nova Scotia, 1920. RHODORA **23:** 284–300. (*Aster*, pp. 294–295.)

——— 1922b. Notes on the flora of western Nova Scotia, 1921. RHODORA, **24:** 201–208. (*Aster*, p. 205.)

Gray, Asa. 1882. Notes on the North American Asters in the older herbaria. Proc. Amer. Acad. **17**: 164–176.

——— 1884. Synoptical flora of North America. Vol. 1, pt. 2.

Shinners, L. H. 1941. The genus Aster in Wisconsin. Amer. Midl. Nat. **26**: 398–420.

Weatherby, C. A. 1942. Two weeks in southwestern Nova Scotia. RHODORA **44**: 229–236. (*Aster*, p. 236.)
Wiegand, K. M. 1928. Aster lateriflorus and some of its relatives. RHODORA **30**: 161–179.
——— 1933. Aster paniculatus and some of its relatives. RHODORA **35**: 16–38.

DEPARTMENT OF BOTANY,
UNIVERSITY OF WISCONSIN,
Madison.

A NEW SPECIES OF HAPLOPAPPUS FROM SOUTHWESTERN TEXAS

U. T. WATERFALL

LAST August the author made a collecting trip[1] through that interesting desert and desert-transition area, the Transpecos Region of Southwestern Texas. At the first station, selected a few miles northeast of Carlsbad because the vegetation was rapidly changing from the familiar plains type to the very different Transpecosian flora, an odd-looking Composite was noticed, but collected only in unicate. It was not taken again until ten days later near Van Horn in Culberson County, Texas. Upon later examination it proved to be a species of *Haplopappus* which did not fit available descriptions. Its stiffly erect habit, numerous small leaves, very leafy branches terminated by single heads, and rays turning reddish upon drying tend to set it apart from the known species of that genus. In examining Hall's monograph[2] it became evident that it belongs in the *H. phyllocephalus* complex.

Dr. Johnston, who determined or verified duplicates of this collection, in kindly checking *Haplopappi* in the Gray Herbarium found another sheet of this species. It is Dr. Havard's number 88 taken at "Guadalupe Mts., W. Texas". Dr. Johnston writes, "Gray was troubled in identifying it (a good specimen) and finally wrote on the sheet, 'Hybrid of *A. rubiginosus* and *Aster gymnocephalus*'." I believe, however, that it is a distinct

[1] Funds to defray the expenses of this investigation were furnished by the Carnegie Institution through the kind offices of Dr. Forrest Shreve of the division of Desert Investigations of the Carnegie Institution. Tucson, Arizona,

[2] Hall, H. M., *The Genus Haplopappus. A Phylogenetic Study in the Compositae.* Carnegie Inst. of Washington, Pub. 398. 1928.

species, and am naming it in honor of its first collector, Dr. Havard.

HAPLOPAPPUS **Havardii,** sp. nov. Planta erecta rigida foliosa glandulosa, annua vel biennis. *H. annuo* affinis, a quo differt glandulis confertioribus, foliis numerosis minoribus obtusis breviter dentatis, capitulis minoribus ramulos conspicue foliosos terminantibus.[1]

Plant 2 to 4 dm. high, stiffly erect, annual or biennial from a short taproot. Stem solitary, branched above, pubescent with capitate glands. Leaves numerous, oblanceolate to oblong, principal cauline leaves oblanceolate to spatulate, 2 to 3.5 cm. long and 2 to 4 mm. wide, reduced upward toward the heads. All the leaves rather regularly but not deeply toothed, the rameal leaves with narrow salient teeth, the principal cauline leaves with more broadly triangular ones, most of the teeth not bristle-tipped, although the larger ones may have a few teeth with a short mucro; leaves capitate-glandular on both sides and on the margins. Heads about 1 cm. long, turbinate, solitary on the ends of leafy branches, subtended by one or two entire much-reduced leaves. Phyllaries linear, glandular, stiff, having a middle strip of green expanding toward the tip, or the longer inner ones having the strip of green only on the upper half. Ray-florets 8 to 10 mm. long and about 1 mm. wide in the expanded upper part, pistillate, but non-fertile, yellow, some of them turning reddish on drying. Disc-corollas 5 to 6 mm. long, yellow. The narrowly triangular, acute, pubescent stylar appendages from 2/3 the length of the stigmatic lines to almost equalling them; style-branches below the sweeping-hairs somewhat granular-glanduliferous, especially on the backs. Achenes about 2.5 mm. long, spindle-shaped, quadrangular at the top, sericeous-pubescent, obscurely nerved: pappus minutely barbellate. Receptacle alveolate, the alveolae scaly around the margins.

The three known collections of this species came from east of the Guadalupe Mountains in New Mexico, from the "Guadalupe Mts., west Texas", and from south of these mountains in southern Culberson County. The first is the author's number 3707 collected in sand on rolling plains in a *Mimosa-Gutierrezia* assn. along the Quahada Ridge, 12 miles northwest of Carlsbad, Eddy County, New Mexico; unicate in the Gray Herbarium with a fragment in the author's private herbarium. The second is Dr. Havard's number 88. The third is the author's number 4153 taken in rocky, white (perhaps gypseous) soil in an association

[1] For aid in preparing the Latin diagnosis I am indebted to Dr. I. M. Johnston.

of *Larrea*, *Flourensia*, and *Gutierrezia*, 9 miles east of Van Horn, Culberson County, Texas. This number (my 4153) in the Gray Herbarium is selected as the TYPE. Isotypes are in the herbaria of the Desert Laboratory of the Carnegie Institution, the Missouri Botanical Garden, the New York Botanical Garden, and in the author's private herbarium. Not all the isotypes have well developed lateral branches.

OKLAHOMA CITY, OKLAHOMA.

MINOR TRANSFERS AND FORMS IN CIRSIUM.—In studying *Cirsium* the following transfers have been found necessary:

CIRSIUM HORRIDULUM Michx., forma **Elliottii** (Torr. & Gray), stat. nov. Var. *Elliottii* Torr. & Gray, Fl. N. Am. ii. 460 (1843). *Cnicus horridulus* Ell. Sk. ii. 272 (1822), not *Cirsium horridulum* Michx. (1803).

Cirsium horridulum, described by Michaux from "pascuis ruderatisque Carolinae", is assumed to be the wide-ranging plant, from Texas to Florida, northward to southern Maine, with the large foliaceous bracts equaling or overtopping the true involucre, the phyllaries eciliate, the corollas creamy to yellowish, the principal cauline leaves with broad and more or less quadrate lobes. This has always been taken as *C. horridulum* but earlier authors, Torrey & Gray and others, did not recognize the recently described southern plants, *C. Smallii* Britton, based on *Carduus pinetorum* Small (1913), not *Cirsium pinetorum* Greenm. (1905), and *C. vittatum* (Small) Small (1913), which started as *Carduus vittatus* Small (1905). *C. Smallii* has smaller heads than *C. horridulum*, with the foliaceous bracts relatively short, the phyllaries erose-ciliate and the deeply pinnatifid leaves with more lance-attenuate lobes. *C. vittatum* is similar to it but with merely undulate-toothed leaves and the phyllaries less definitely ciliate. Whether the latter is a distinct species or an intermediate between *C. horridulum* and *C. Smallii* is yet to be determined. All three occur in the Carolinas, as does the purple-flowered plant described by Elliott. Until Michaux's type of *C. horridulum* can be restudied I am holding it in the sense defined by Small.

C. MUTICUM Michx., forma **subpinnatifidum** (Britton), stat. nov. *Carduus muticus*, var. *subpinnatifidus* Britton in Britton & Brown, Ill. Fl. iii. 489 (1898). *Cirsium muticum*, var. *subpin-*

natifidum (Britton) Fernald in RHODORA, x. 95 (1908).—Merely a leaf-form.

C. PUMILUM (Nutt.) Spreng., forma **fultius,** f. nov., capitulis valde bracteatis, bracteis foliaceis numerosissimis (25–40) confertis involucro superantibus.—CONNECTICUT: Wethersfield, 1878, *Chas. Wright* in Herb. Gray.

A most extraordinary form, the 25–40 crowded leafy bracts much longer than the involucre and forming a dense rosette at its base.

C. PUMILUM, forma **candidum,** f. nov., floribus albidis.—MASSACHUSETTS: Ashby, July 12, 1889, *W. H. Manning* (TYPE in Herb. New England Bot. Cl.).

A word should be said regarding the name *Cirsium pumilum* (Nutt.) Spreng. It started with Nuttall, Genera, ii. 130 (1818), but many recent authors, Porter, Petrak, Britton and Small, have started the binomial with *Cnicus odoratus* Muhl. Cat. 70 (1813) getting, under *Cirsium*, the resultant combination *Cirsium odoratum* (Muhl.) Petrak in Bot. Tidsskr. xxxi. 68 (1911). Had Petrak looked up *Cnicus odoratus* in Muhl. Cat. l. c. he would have found merely the translation (as usual there) of the name and the locality and date:

purp. 7.odoratus 2l sweet-scented Pens. fl. Jul.

That, like so many of the names in Muhlenberg's *Catalogus* is a *nomen nudum*. No species was described. Barton, Compend. Fl. Phil. ii. 95 (1818), was the first to associate Muhlenberg's *Cnicus odoratus* with a description. He there copied the essential points of Nuttall's description of *Cnicus pumilus*, cited Nuttall as his source and also cited *C. pumilus* Nutt. as a synonym. The record of copyright of Nuttall's second volume in the District of Pennsylvania states that Nuttall registered the volume "on the third day of April", 1818, the affidavit signed by D. Caldwell. Mr. Caldwell's affidavit states that Barton's 2nd volume was entered for copyright "on the ninth day of July", 1818. *Cirsium pumilum* seems to have right of way.—M. L. FERNALD.

A NEW FORM OF PRUNUS VIRGINIANA FROM INDIANA AND ILLINOIS.—As it occurs throughout its range from Newfoundland to eastern South Dakota, and southward to Kansas and Florida, the common eastern American chokecherry, *Prunus virginiana* L., is a shrub or small tree with leaves, young twigs, pedicels, and

rachises nearly or quite glabrous. However, occasional specimens from Indiana and Illinois, and perhaps elsewhere, have the lower surface of the leaf-blades, the petioles, young twigs, and the rachis and pedicels of the racemes more or less pubescent. There appears to be no other morphological character, or ecological or geographical difference to separate these two forms. In 1920 C. S. Sargent supposed this pubescent form of *P. virginiana* to be the same as *P. demissa* (Nutt.) Dietr. of the Pacific Coast, and he was followed in this conclusion by C. C. Deam in 1924, and again in 1940. A more plausible interpretation, and one that harmonizes satisfactorily with the known principles of the phytogeography of the Central States, is that the leaves and inflorescences of *P. virginiana*, like those of the western *P. melanocarpa* (A. Nels.) Rydb., although usually glabrous or glabrate, show occasional variation toward the pubescent condition. Even as the pubescent form of *P. melanocarpa* has been named f. *Rydbergii* Koehne, after the late Dr. P. A. Rydberg, we now name the parallel variation of *P. virginiana* in honor of the outstanding veteran botanist of Indiana, Dr. Charles C. Deam. It may be designated:

PRUNUS VIRGINIANA L. f. **Deamii,** forma nov. *Prunus virginiana* var. *demissa* Sargent in Journ. Arnold Arb. **2:** 115. 1920; Deam, Shrubs of Indiana 155, 1924, Fl. Indiana 581. 1940. Non *Cerasus demissa* Nuttall ex Torrey & Gray 1840.—Formae typicae statura habitu etc. similis; foliis rachibusque pubescentibus. Lower surface of leaves conspicuously pubescent; young twigs and rachis of inflorescence tomentulose; racemes shorter and more compact; leaf-blades somewhat thicker.—INDIANA: Millers, Lake Co., August 14, 1911, *C. C. Deam* 9572 (TYPE, NY); Michigan City, La Porte Co., *Deam* 6443, 7088 (NY); Graveyard Lake, Steuben Co., *Deam* 8860 (NY). ILLINOIS: along Rock Creek near Rockville, Kankakee Co., May 10, 1941, *G. Neville Jones* 13518 (UI); five miles northwest of Bonfield, Kankakee Co., May 10, 1941, *G. Neville Jones* 13563 (UI); Starved Rock, La Salle Co., *Greenman, Lansing, & Dixon* 130 (NY); Wady Petra, Stark Co., *Virginius H. Chase* 437 (NY, UI).

This form of *Prunus virginiana* L. is quite distinct from the western American *P. demissa* (Nutt.) Dietr. That species, which ranges from British Columbia to California, differs from *P. virginiana* and its f. *Deamii* in its larger petals, longer anthers and style, dark purple fruits, and different habit of growth.—GEORGE NEVILLE JONES, University of Illinois.

OUR ALBINO LUPINE.—*Lupinus perennis* L. commonly has the petals blue-purple, more rarely pink (forma *roseus* Britton) and occasionally white. The white-flowered forma *albiracemus* A. H. Moore in RHODORA, xvi. 129 (1914) and the Michigan forma *bicolor* Farwell in Am. Midl. Nat. xii. 123 (1930), with two contrasting madder tones in the flower, both belong to the inland var. *occidentalis* S. Watson. In order that our white-flowered form of typical *L. perennis* of the Atlantic slope may have a convenient designation I am calling it

LUPINUS PERENNIS L., forma **leucanthus,** f. nov., petalis albidis. TYPE: dry gravelly, open hill, New Milford, Connecticut, June 9, 1932, *E. H. Eames*, no. 11,401 (in Herb. Gray.).

—M. L. FERNALD.

EASTERN EXTENSION OF CIRSIUM FLODMANI.—The species of prairie and plain, *Cirsium Flodmani* (Rydb.) Arthur, is generally supposed to extend eastward into Manitoba, Minnesota and Iowa. I find in the Gray Herbarium, however, two sheets of specimens from farther east: one from dry clearing, Temagimi Forest Reserve, Ontario, July, 1922, *W. R. Watson*, no. 5963 (originally identified by me as *C. undulatum*); the other from a sandy field east of Minerva, Essex County, New York, August, 1927, *House*, no. 15,166 (distributed as *C. altissimum*). It will be interesting to know whether these are native stations or whether the plant is migrating eastward.—M. L. FERNALD.

Volume 45, no. 536, including pages 305–332, was issued 10 August, 1943.

OCT 15 1943

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. October, 1943. No. 538.

CONTENTS:

Virginian Botanizing under Restrictions. *M. L. Fernald.* 357

Notes on Solidago, Section Euthamia. *Stuart K. Harris.* 413

Tragopogon dubius in Indiana. *Edwin D. Hull.* 413

New Species of Deschampsia. *W. E. Booth.* 414

Date of Publication of Pursh's Flora Americae septentrionalis. *W. T. Stearn.* 415

Unusual Habitat for Cuscuta compacta. *C. A. Weatherby.* 416

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to
M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY
Specialists in Scientific and Technical Publications
EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,
Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

H pl.770-782

Photo. E. C. Abbe.

Malicious and falsely Incriminating IRIS VERNA
(see pp. 360, 362 and 363)

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. October, 1943. No. 538.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CXLIX

VIRGINIAN BOTANIZING UNDER RESTRICTIONS

M. L. Fernald

(Plates 770–806)

Part I. Field-Studies of 1942 and 1943

At the approach of spring in New England in 1942 my former student, Professor Ernst C. Abbe of the University of Minnesota, then spending a year in research at the Gray Herbarium, was persuaded without too much pressure to contribute the use of his new Ford and to join Mr. Bayard Long and me for a short period of botanizing in southeastern Virginia. The need to go at once to the region arose through the pressure for housing near Camp Lee, with the result that our former headquarters at Century House, south of Petersburg, had been wholly taken over by Army officers and our great stock of driers, ventilators, press-frames, tramping clothes, etc. had been temporarily stored in a shed. There was no place left near Petersburg for such unessential people as mere botanists and we would have to move.

Abbe and I drove from Cambridge, with spring still far in the offing, and on the afternoon of April 15th called in at Elkins Park for Long and, taking a thinly settled route (via Glen Burnie, LaPlata and Port Conway) out of Baltimore, reached Fredericksburg for the night. Starting from Fredericksburg on the morning of the 16th we decided to drive down the north side of the Rappahannock to the Port Conway-Port Royal bridge,

thence to Petersburg. We might thus add something to the *Checklist of Plants of the Washington-Baltimore Area*, which covers the region south to the Rappahannock. About three miles southeast of Falmouth we were attracted by a brook cutting a ravine through the woods and by the conspicuous display of such plants now in flower or fruit as *Arabis laevigata*, *Stellaria pubera* and *Corydalis flavula*. Parking just off the road at the eastern end of the bridge we stepped into a colony of *Ranunculus abortivus* var. *indivisus* Fernald in Rhodora, xl. 418, pl. 518 (1938), the extreme of the species characteristic of bottomland woods of the Nottoway, ninety miles to the south; and when, a little farther on, we were puzzled by the *Cerastium* of the roadside-fill and found it to be the European *C. brachypetalum* Desportes, which has been known in America only from roadsides of Southampton County, Virginia, we felt that we were promptly getting into stride. But we were obligated to reach Petersburg and to move our collecting equipment to new quarters. Our chief concern was not the Washington-Baltimore Flora.

In the autumn of 1941 we had found not very far down river from Port Royal a fine bank of naturalized trees and shrubs and we wanted to secure flowering material of *Vinca major* L., which abounds there. So we took a little time to drive out to the home of Mr. and Mrs. Snowden on the river-bluff northwest of Return. After a visit with our hosts we reëxamined the colony of naturalized species along the river[1] and among them, unnoted the autumn before, there were *Ulmus procera* Salisb., the English Elm, and the American *Philadelphus inodorus* L. Then we went to the woods northeast of Loretto where, the preceding October, *Poncirus trifoliata* (L.) Raf. was fruiting[2], hoping to get good flowering material. Luck was still with us, the shrubs being in the prime of flowering. Since the day was rapidly passing we then decided to drive from Tappahannock without stop to Petersburg. We did pretty well, stopping first for a few moments to look into a wet woodland glade where we found two species rare in southeastern Virginia, *Viola cucullata* and *Symplocarpus foetidus;* but when we came to the broad, green, wooded bottomland of the Pamunkey, slightly north of Old Church, we had to get out for just a peep. The usual plants of such habitats

[1] See Rhodora, xliv. 372 (1942). [2] Rhodora, l. c.

were there, *Clematis crispa*, *Cardamine bulbosa*, and a perplexing member of the *Ranunculus hispidus*-series, and with them *Viola pensylvanica* Michx.[1], rare on the Coastal Plain. The great surprise, however, was acres and acres, as if native, of splendid flowering clumps[2] of the Old World Summer Snowflake, *Leucojum aestivum* L., as thoroughly at home as any squatter and making a display which we shall never forget.

While we were busily exploring this bottomland we heard excited voices of Negroes and the hurrying of feet on the road near by; and when we came up from the woods, a man, sauntering quietly along the road, waited for us to greet him and to explain our strange doings. The colored women had rushed excitedly to his filling-station to report three terrible monsters down on the bottomland across the river, one of them with an axe (my little hand-pick), one with a can of dynamite (vasculum), the third with a big pack on his back (Long's field-press). The women had "runned and runned and runned" and were completely out of breath and greatly frightened. Thus the three devotees of what Linnaeus called "our guileless science" were unconsciously starting the reputation which it became difficult to live down in succeeding days in Virginia. The proprietor of the gasoline-station told us of the vast extent of the bottomland-woods, of the fresh tidal flats near by and of his readiness to guide us about the region, and we promptly arranged to employ him and his motor-boat in midsummer and autumn, then little realizing that midsummers and autumns would pass before we should again see the Pamunkey.

The roadside-fill (soft shoulder) near where we had parked the car was carpeted with two wanderers from Europe, *Teesdalia nudicaulis* (L.) R. Br. which we had only once found in the state (on a fill in Sussex County) and *Holosteum umbellatum* which we subsequently saw in other such habitats. The large number of Europeans suddenly appearing on these recently made soft shoulders (these, *Cerastium brachypetalum*, *C. tetrandrum* Curtis, and other European species) make one wonder about the source of seed sown on the soft shoulders of new roads in eastern Virginia.

[1] See Rhodora, xliii. 500 and 616 (1941).
[2] See Rhodora, xliv. 390 (1942).

Six or eight miles below Petersburg we found a place to sleep—in cabins where they were asking and getting $4.00 a night for each bed over the week-ends from families visiting loyal sons and brothers at Camp Lee, twelve miles away. There were no "ceilings" on cabins. Only as a special concession were we taken in on a Friday night, for the cabins were being rented only Saturday and Sunday nights during the activity at Camp Lee. Finding next morning that the Petersburg region was no longer available as a home, we decided to try Waverly, twenty-five miles to the southeast, a village in the center of good botanizing ground and at the junction of good roads. We had formerly enjoyed the hospitality there of Mrs. Carter and her daughter, Mrs. Fleetwood, in their large old house, and we decided to try there; but Mrs. Fleetwood, we promptly learned, was at Fort Eustis as hostess and the old house was occupied by the family of an Army officer, who was forced daily to make the trip to and from Camp Lee. Southeastern Virginia was in the hands of the Army. Happily, our friend, Mrs. Calvin Horn, who, with her husband, runs an automobile- and gasoline-station at Waverly, was able to suggest a new home and in the evening we were established in the roomy and comfortable house of Mr. and Mrs. James Thompson and our equipment was stacked and ready for use.

Promptly after breakfast on the 17th we started eastward to take a cross-road north to the James River. Only a few rods outside the village Abbe spied a fine colony of *Iris verna* in beautiful flower. It must be photographed. For three minutes he tested light and distance, with his camera pointing down to the innocent *Iris*, passing cars slowing down to watch the proceedings. Then we went on to the James River, visiting then and two days later areas above Claremont, at Claremont Ferry and at Burwell's Bay below Rushmere, and introducing Abbe to the complexities of the eastern Crabapples, now in bloom, and to such fine natives as *Cardamine Douglassii* and *Sedum ternatum*. On the weedy and turfy shore at Burwell's Bay the little *Stellaria media* var. *glaberrima* G. Beck[1] made carpets with *Ranunculus parviflorus* and we here extended the range inland from the outer coast of the odorless, onion-like *Nothoscordum bivalve*.

[1] See Rhodora, xlii. 451 (1940).

We were specially anxious to show Abbe the big white-flowered *Erigeron scaturicola* Fernald in Rhodora, xliii. 524 and 654, pl. 695 (1941), which grows in the deep and viscid, dripping wet lime-marl under the crest of the bluff west of Burwell's Bay. We found typical *E. philadelphicus* on the beach, then plants like small *E. scaturicola* but with pink, instead of white, rays began to appear and finally, high up under the dipping crest, just where a magnificent mass of white-rayed *E. scaturicola* had formerly grown, there was an equally vigorous clump of plants with deep pink ligules. It was difficult to believe and I, naturally, wanted to get rooting specimens. These, after he had slipped back several times on the wet marl, Abbe dug and threw down. White-rayed *E. scaturicola* was now pink! The dry material was stored in a pigeon-hole to await critical study and nine months later, when reëxamined, its rays were all white. The smaller and more typical *E. philadelphicus* has retained, as usual, the bright pink of its ligules. Again, ho-hum! *E. scaturicola* is, presumably, a physiological variant of *E. philadelphicus*, induced by the concentrated calcium solution and cold water in which it grows. This is the view of Mr. Arthur Cronquist who is studying the genus. Whereas *Aster* is reputed to be hopelessly plastic and inconstant, *Erigeron* is usually well behaved. The "strong waters" along the bluffs of the James have there evidently "gone to the head"s of one member of the relatively conservative genus. It would be instructive to feed ordinary and typical *E. philadelphicus* for some years on refrigerated lime-water.

On the way back to Waverly on the following Monday, as we crossed Cypress Swamp north of Dendron, we stopped to collect typical *Senecio aureus* in the bottomland-woods and as we came back to the car there, at the upper border of the bottomland, we saw a row of plants combining in different degrees the habit and traits of *S. aureus* with those of the very definite and wholly different *S. tomentosus* which was flowering in the drier open areas. It was clear that *S. aureus* and *S. tomentosus* sometimes cross, and Long and I immediately remembered a single colony on a bottomland west of Claremont which we had hopefully identified with *S. Crawfordii*[1]. Was it possible that that, too, was a hybrid? As I shall later show, it is. We thus returned

[1] See Rhodora, xliii. 521 and 657 (1941).

to Waverly at dark, after happy initial days but with some pretty baffling problems in mind and the first evening there we immediately met the greatest problem of all.

When we parked the car outside the café, I promptly went in and sat at a table, but I was soon puzzled because Long and Abbe did not come in. Finally Long appeared at the door and mysteriously beckoned. When I went out, wondering at his action, he met me with the query, "Have you got your credentials? We're pinched." "Why?" I asked. "Because Abbe took a photograph." My credentials (an identification-letter from the President of Harvard University; a letter from the Secretary of the National Academy of Sciences emphasizing that as a member I was a scientific advisor to the federal government; a letter addressed to me as President of the Botanical Society of America; a newspaper-clipping with a picture of me as recipient of a medal, in part for the botanical explorations in Virginia; and a passport with portrait) and my statements regarding the distinguished American forebears of both Long and Abbe promptly convinced the police that we were not, as supposed, German spies who had crossed the Atlantic and had sought out the small village of Waverly for destruction. In the morning when little *Iris verna* was being photographed a zealous Waverly citizen, unacquainted with any such interest as that, had telephoned to State Police headquarters in Richmond of the "furrin" car (from Minnesota) with three "spies" who were photographing the Norfolk and Western railroad-tracks, the Texaco oil-tank and other vital landmarks of the community, for it did not occur to him that our backs were toward the unsightly railroad, with the small oil-tank farther in the background, that the camera was pointed exactly away from those significant objects at something on the ground and that our small botanizing pick (see PLATE 770) was not the implement to use in ripping up the heavy steel rails of the Norfolk and Western. Telephone conversation with the motor-registry in Minneapolis revealed that the car belonged to Professor Abbe, with the incriminating given name Ernst. Radio calls had gone all over southeastern Virginia for all officers to halt our car; and all day long we had innocently driven on the Suffolk turnpike (U. S. Route 460), on the road from near Wakefield to Surry Courthouse (Route 31),

on the Richmond-Smithfield road (Route 10) or on the road from Claremont to Waverly and far beyond, across the state (Route 40). We did not know that we were reputed German spies and that the State Police were watching for us. When we got back to our new home Mrs. Thompson was, naturally, upset. Her husband, the village barber, had come home to noon dinner with the tale, much amplified in the barber-shop, of the terrible mess they had got into, "harboring German spies"; but my documents and the realization that Long and I had for several years known Mrs. Horn, Mrs. Carter and Mrs. Fleetwood, and had more than once been guests at the latters' home, and had regularly stopped in Waverly for meals during several years of botanizing, cleared the atmosphere. Nevertheless, next day some ladies from the other end of the town came to Mrs. Thompson to commiserate. They "hadn't slept a wink, expecting to be murdered in their beds", etc., etc. Thus our début at Waverly was even more horrifying than our appearance on the bottomland of the Pamunkey, and half-jesting, half-serious questions through this trip and on Long's and my June-July trip indicated that the first impression of us "furriners" was still in people's minds. We had become used to being "damn Yankees"; Long and I had once been arrested in Richmond as "German spies" (see RHODORA, xliii. 516); but it was a novel experience to be called "furriners". The people of Waverly are typical Virginians and, consequently, strongly for the "New Deal". They avoided addressing any such obvious heretics as we as "Professor". Baldness having advanced on all of us, we, perhaps, did not fulfill their conception of "long-haired professors". Since I know of no published photograph of *Iris verna* in its native habitat the photograph which so upset the equilibrium of southeastern Virginia and which somewhat "cramped our style" is here presented, as they say in all criminal cases, as exhibit A (PLATE 770).

Desiring to secure in flower the remarkable variations of *Acer floridanum* (Chapm.) Pax near Grove Landing, below Williamsburg, which were discussed and illustrated in RHODORA, xliv. pp. 359, 360, 426–428 and plates 725–727 (1942), and hoping to make the field-acquaintance of *Monotropsis odorata*, one of the Williamsburg specialties, we went on Sunday to William and

Mary as the guests of my former student and Abbe's friend of student days, Professor Albert L. Delisle, and in the afternoon we made a pretty thorough canvas of the *Acer* problem. That has already been reported upon, but when we came to a tree with the trunk more than 4 feet in diameter and with its great sheets of exfoliating whitish bark flapping like those of shagbark-hickory we could not help mourning our inability to get a photograph of it. The herbaceous plants of this rich forest were noted a year ago. To that list should be added *Nothoscordum bivalve* which the day before we had got on the opposite side of the James. After supper Delisle's student, a keen searcher for and discoverer of rare plants, Mr. Kenneth Winfield, took us to his station for *Monotropsis*. It was necessary for him to show us the first clump of slightly too mature plants; after that we found more and more. This aromatic saprophyte really abounded. Its favorite habitat was in the leaf-mold in the shelter of fallen and decaying logs. We thought we had learned how to find it but later searches on similar slopes elsewhere were fruitless.

In April, 1926, Dr. Paul A. Warren collected in the Great Dismal Swamp a dwarf *Trillium* which I had misidentified as the extreme southern *T. lanceolatum* Boykin but which is not satisfactorily referable to that species. Its sessile flowers easily lead to *T. lanceolatum* but in other characters it is near *T. pusillum* Michx., a species with peduncled flowers. Dr. Warren and a party of students from William and Mary had walked in on the old path from Wallaceton to Lake Drummond. The path now being obliterated by dense growth and by tangles of briers following forest-fire, we went in search of the *Trillium* via the Feeder Ditch in Capt. Crockett's motor-boat. The search was futile but the excursion delightful and when we came back from Lake Drummond to the Federal dam, the engineer, Mr. Cherry, asked what particular plant we were seeking. When I described it he promptly said: "I never saw it but once, on a hillside covered with beech-trees where it abounded when I was a boy". His explicit directions took us back to the beech-slope described, near Deep Creek, now a picnic-ground, trampled and scraped and with no *Trillium* left. Most fortunately, however, Mrs. Laura H. Lippitt of Dinwiddie has a good station for the plant and the beautifully prepared specimens she has sent me and others

loaned me by Professor Smart of the University of Richmond enable me to describe and illustrate (PLATE 773, FIGS. 1 and 2) this endemic Virginian *Trillium*.

The season was too early for many novelties, though on succeeding days we extended some local ranges and renewed our acquaintance with numerous vernal species, but nothing significant enough for special note was collected.

Unfortunately, when we could next get away Long and I had to go without Abbe. We reached Waverly in the afternoon of June 28th and, beginning early on the 29th, we had all we could handle until obliged to leave on the morning of July 8th. Mr. Horn was able to supply a pick-up truck to transport our equipment and he found a very efficient driver and helper for us, Lennie Watts, son of a local police-officer, young, full of activity and interest and as effective a driver on back roads as our best drivers of other years. Only three of our old stations were specially revisited. We did not let ourselves be lured to the marl-bluffs of the lower James or north of that river and we did not get down to Greensville County or the pine barrens of southeastern Southampton and southwestern Nansemond. Gasoline was becoming scarce and must be stretched to cover all mileage possible, but we had a careful driver and an efficient truck and Mr. Horn kept it up to full effectiveness.

Nearly west of Waverly we went as far as McKenney in Dinwiddie County. In October of 1941 we had found just east of McKenney an area of low woods and clearings where typical Coastal Plain plants (*Helianthus angustifolius*, *Cirsium virginianum*, and *Solidago perlonga* Fern.) extended well back into the Piedmont and mingled with eastern colonies of upland types such as *Viburnum Rafinesquianum* Schultes. There, too, were the second station north of northwestern Georgia of *Gentiana cherokeensis* (W. P. Lemmon) Fern. and the third station in the state for the characteristic species of prairies of the Interior (Indiana to Texas), *Muhlenbergia brachyphylla* Bush. Such a complex area demands exploration through the summer and autumn and on the 1st of July it was up to its October standard. *Viburnum Rafinesquianum* was more abundant than we remembered; the local *Phlox carolina* L., var. *triflora* (Michx.) Wherry shared a low clearing with *Vicia caroliniana*, *Thalictrum re-*

volutum, *Scleria oligantha* and other rather local species not seen in October. The ditch bordering the woods was the home of *Polygala sanguinea* (rare in southeastern Virginia) and *Rhexia ventricosa* Fern. & Griscom in Rhodora, xxxvii. 192, pl. 346 (1935), its range extended inland, and the *Oenothera* looked, as they so often do, a little strange. A couple of pieces were taken for checking. Next time we will get more, for it is *Oe. tetragona* Roth, var. *riparia* (Nutt.) Munz in Bull. Torr. Bot. Cl. lxiv. 302 (1937), known to Munz only from its original region, Cape Fear River at Wilmington, North Carolina, and the Santee River region of South Carolina. We were hot and hungry. So, seeking a shaded spot, we sat down in a colony of the inland, continental *Psoralea psoralioides* (Walt.) Cory, var. *eglandulosa* (Ell.) F. L. Freeman in Rhodora, xxxix. 426 (1937), Miss Freeman's statement of range being: "Higher altitudes of the Southeastern States, in South Carolina and Georgia, ranging westward as far as Texas, thence northward to Ohio, Indiana, Illinois, Missouri and Kansas". This *Psoralea* and the *Oenothera* were as fine a pair as *Muhlenbergia brachyphylla* and *Gentiana cherokeensis*, found here in October. *Solidago perlonga* we had always considered an autumnal species and it was still in good condition here the preceding October, but already precocious individuals were beginning to flower—the species has a flowering period of four months! *Clematis ochroleuca* was here very large, some plants branching at every axil and bearing 8 fruiting heads. Since the classification of the sub-§ *Integrifoliae* of *Clematis*, § *Viorna* has recently depended too much on inconstant vegetative, rather than more stable fruiting characters, I have tried to find the latter in the eastern American species. My results, with plates 776–782, will be found in Part II.

On the way back to Stony Creek we stopped at several inviting spots. Only one may here be noted. The unique and to most botanists very rare *Carex Collinsii* Nutt. (unique in having the teeth of the perigynium abruptly recurved as hooks, thus suggesting the very primitive subantarctic and Asiatic *Uncinia* which has the exserted rachilla abruptly hooked) inhabits cool spring-fed sphagnous carpets in wooded swamps. Since we first detected it in Virginia we had learned to expect it in such habitats. Consequently, when we saw such a deep carpet of sphag-

num in the woods east of Cherry Hill, we investigated. There was *C. Collinsii*, already over-ripe, and with it was true southern *C. venusta* Dewey at a new northern limit.

Three Creek, tributary to the Nottoway, has yielded us more localized specialties than any other small stream in southeastern Virginia. Wherever we have been on its bottomlands and wooded banks, from the fall-line north of Emporia nearly to its mouth, we have got something novel. The Arringdale Sheet of the Topographic Survey indicated good bottomlands at Arringdale and, slightly farther up stream, near Adams Grove. So, having never tried them, we drove from Capron by the dirt road toward Arringdale. Closely watching the topographic sheet, we sought the crossroad to the village which lends its name to that invaluable guide through the country. Nothing but dense thickets and woods could be found. Turning the car we drove back to definite landmarks. Finally, seeing a colored girl coming toward us we waited and, as she came up, asked: "Will you please tell us how to find Arringdale?" "Irene Dale?" she promptly replied. "I've never hearn of her. I know Irene Dunn up the road a ways but I never hearn of Irene Dale." Arringdale has become extinct; its fame is perpetuated only on the contour-sheet!

It was a sweltering day and the thought of plunging through dense thicket in search of sinuous Three Creek was not inviting; so we went on to Adams Grove. As we crouched in the shade of the small bridge there, to keep out of the blazing heat while we ate our lunch, we were able to note around us several extensions of range to the west, pretty closely approaching the fall-line: *Sagittaria Weatherbiana* Fern. in Rhodora, xxxvii. 387, plates 385 and 386, fig. 1 (1935), *Carex Bayardi* Fern. in Rhodora, xliv. 71 (1942) and *Micranthemum umbrosum* (Walt.) Blake, for example; and as we lunched we were impressed with the somewhat "fluffy" aspect of the meagre umbels of the *Sium* at the margin of the Creek. Its foliage, too, was unlike that of the common northern plant, and its slender and flexuous, terete stems were not like the strongly corrugated and usually coarser stems of the plant commonly known as *S. suave* Walt. or *S. cicutaefolium*. This was young flowering material of the species which we had previously collected in fruit on the bottomlands

of the Blackwater and of Fontaine Creek. They all belong to *S. floridanum* Small, known to Small only from a single valley in Florida. It sometimes pays to stop and eat lunch!

We saved up our allotted gasoline until we had enough to reach the region of Northwest River, flowing from the Great Dismal Swamp into Curratuck Sound. There is always something different to be found on the marshes near Northwest or along adjacent North Landing River; it is important to visit them at all seasons. On the way, a little east of Magnolia, white flowers on the surface of one of the big ditches along the highway across the northern end of the Great Dismal Swamp attracted us, and we got out to collect our first material in the region of *Cabomba caroliniana*. As we approached Northwest we were surprised to see a striking and very "different" *Physostegia* bordering Indian Creek. We were quite familiar, on the wooded bottomlands of the Blackwater and the Nottoway, farther inland, with the delicate and thin-leaved *P. denticulata*, but this was a much coarser plant with larger corollas, heavy and subsessile (instead of membranous and long-petioled) leaves and other characters which quickly distinguish it. Unfortunately, the colony was densely enmeshed by *Cuscuta* but we cleaned off enough material to make a good type and in Part II I shall describe and illustrate it (PLATE 783) and attempt to clarify the genus in the "Manual range". Days at intervals of three weeks in a motor-boat along Indian Creek will sometime be very productive. So will days at similar intervals on little Blackwater River near by and, likewise, on Northwest River, both up stream and down to the Carolina line. Furthermore, North Landing River, with its broad savannah-marshes needs similar exploration. There is plenty to do; we have merely glimpsed the easily accessible margins of these areas. On the reed-marsh of Northwest River the always superb orange- and red-flowered *Asclepias lanceolata*, var. *paupercula* (Michx.) Fern. was very handsome and one plant had bright, pale yellow corollas, a pretty color-form. I took the top, Long wistfully remarking, "We'll come again next year for mine". When we are again able, after the "duration", to visit Northwest there may be more than a single yellow-flowered plant. Here's hoping! And if we are there at the right season we may secure better material of the undescribed

Solidago which, when we found it in October of 1941, had been mowed off and was, therefore, not typical. The thicket bordering the marsh is also the home of a new variety of the wide-ranging and variable *Eupatorium rotundifolium*. Whereas typical *E. rotundifolium* has the leaves gently rounded to subtruncate at base, this plant of Northwest River has the unusually large blades deeply cordate, with the bases clasping the densely white-tomentose stem. We afterward found it in a marshy thicket in Southampton County, and Godfrey got the same extreme variety only a few miles to the south, in Bertie County, North Carolina. It will be described and discussed in Part II. Another plant, a very bristly *Stachys*, on the reed-marsh of Northwest River, added to a large series of different members of the genus accumulated during several seasons in southeastern Virginia, has forced me finally to tackle the group. The results, with many illustrations (PLATES 787–794), will be given in Part II.

July 4th, even with restricted gasoline, may be an unsafe day for cautious and virtuous drivers on trunk-routes. So, when Lennie asked if we might keep off the main roads on that day, to avoid drunken drivers, we remembered that there had been extensive lumbering operations in the pine barrens south of Zuni, with the consequent partial clearing of new lumber-roads and the opening to sunshine of formerly shaded areas. That was the place to go. Clearing and disturbing of the soil, while taking the older trees of Long-leaf Pine and many other trees, had certainly stimulated many species and brought others into view. Near one damp, new woodroad *Amianthium Muscaetoxicum*, at a new northern limit in this section of the state, and *Calopogon pallidus* Chapm., its limit of range extended 10¾ miles to the north, stood up bravely in the mossy thicket where they had formerly been hidden, and some clearing-phases of *Panicum* and *Tephrosia* puzzled us. When the habitat has become more stable the *Panicum* may look less unfamiliar. The *Tephrosia* is the glabrescent extreme of *T. virginiana*, which we had found in other pine barrens. It is evidently *T. virginiana*, var. *glabra* Nuttall, described in 1838 from Georgia. It seems to be a well defined variety. In the drier white sand *Bulbostylis ciliatifolius* (Ell.) Fern. had its northeastern limit also slightly extended.

But the greatest display in the recently disturbed sand was of *Euphorbia Ipecacuanhae*. Under normal conditions this hopelessly variable species flowers in early spring (late March into April) but here in the loosened sand it was still in flower and young fruit in early July. Against the suggested explanation that the similar but more upright *E. marilandica* Greene might be a hybrid of tall and erect *E. corollata*, flowering in Virginia from early June to autumn, and depressed and matted *E. Ipecacuanhae* the reply has always been that they cannot hybridize because their flowering periods are so different. The loosened sands south of Zuni dispose of that argument.

At the Blackwater River, near the bridge west of Blackwater School, we established new northern limits for *Asimina parviflora* (Michx.) Dunal and for *Physalis monticola* Mohr, and, crossing the river into Southampton County, we promptly parked the car, for the sandy flat along the river southeast of Unity was very alluring. Most of the plants were of species now known to us but always nice to collect, *Paronychia riparia* Chapm. and *Vaccinium Elliottii* Chapm. at new northeastern limits and some others equally good. The prize here, however, was a large colony of hundreds of uniform plants of a particularly dainty *Ruellia* which, since June of 1941, had worried us. In low, sandy woods at Round Gut on the Nottoway we had then found a colony of *Ruellia*, the mature stems only 2 or 3 inches high, with thin and blunt membranous leaves only 1.5–3 cm. long. The colony was struggling under a pile of brush and had no real chance. So we carefully cleared away the worst obstructions and nursed the colony along, finally to secure a few flowers. Now we have a real station and the plants from it will be the type when a study of *Ruellia* which I now have in progress is completed. Whether it can be finished in time to include in Part II is very doubtful. It is a complex problem, made worse by past inattention to types and original descriptions, and many contradictory interpretations must be reconciled. But the sandy flat southeast of Unity has one member of the genus which we know from Virginia only in Southampton County.

Starting for home, we decided that we could save mileage and time by cutting over to Route 312, from Courtland to Smithfield,

passing through Berlin[1] thence turning off at Ivor for Waverly. On the way we passed roads leading to various ponds which we should have liked to investigate and when we got north of Sedley a little landlocked pond, slightly off our route was too tempting. It was really a small *Cephalanthus*-hole, but in the thicket we promptly detected the new *Eupatorium* of Northwest River. There, also, was *Drosera rotundifolia*, the first we have seen on the Coastal Plain west of the Blackwater, and on a saturated log the very local *Utricularia virgatula* made a close carpet. Driving on to find a good turning-place we came upon Johnson's Millpond. While Lennie was backing and turning the truck we went to the sandy shore. There was *Oldenlandia Boscii* (DC.) Chapman, its range extended 12 miles northward, but in a couple of days we stretched its northern limit more than 12 miles more; and with it *Digitaria serotina* (Walt.) Michx. at its second known station north of the Carolinas. Here too, was *Panicum Wrightianum* Scribn., a species subsequently found on most sandy pond-shores.

Lennie, noting that we had a weakness for pond-shores and marshes, asked next day if we had ever been to Harold's Millpond. We had not, but since in the past most millponds had been fruitless, as artificially dammed branches, and several which we had sought had been abandoned and grown up to cypress- or gum-swamps, we had our doubts. However, we were willing to try. So on the 6th we started for Harold's (on the contour-sheet as Harris) Millpond, southeast of Waverly. It was a dammed-up cypress- and gum-swamp but it was better than most and will stand exploration by boat, for drifted ashore were *Utricularia purpurea*, which we had never met in our Virginia work, and *U. inflata* var. *minor* Chapm. which we had seen only twice. Thus encouraged we decided to try Brittle's Millpond, west of Wakefield. We stuck to the old road, rather than return to the turnpike, and slightly before reaching Brittle's Millpond we investigated a piece of spring-fed sphagnum-carpeted woods. Here the chief interest was centered on a *Xyris*, just coming into flower and not easily matched in the herbarium. It seems to have some distinctive characters but mature material is needed.

[1] Berlin, Baden and Hanover were none of them named in our honor. They were on Virginia maps long before we visited the state.

Brittle's Millpond at once gave us *Panicum Wrightianum* and *Oldenlandia Boscii*, but the shore was not easy to follow and too much punched by the hoofs of grazing animals, so we proceeded southward to see what could be found. And the next pond was a true find.

Suddenly coming into view, Airfield Millpond gave us a real thrill. It had a broad white-sand beach, perhaps 50 feet wide up to the bushes, such a pond as occurs in southeastern North Carolina but such as we had never seen in Virginia. Here we settled down for the rest of the day, until driven out by a thunder-storm and downpour in the afternoon. The rarer pond-shore species of *Panicum*, such as *P. spretum*, were there, the now unmentionable *Oldenlandia* of course, and carpets of all sizes of *Eleocharis microcarpa*, some stranded, some deeply drowned, and so variable in size and in thinness or inflation of culms that we were fooled into imagining it several things. *Paspalum dissectum* gave us a new station, and *Rhynchospora perplexa* Britton lived up to its name. We kept taking it, for on different belts along the beach it looked very different. Dr. Cross (Shirley Gale) says it is all *R. perplexa*, but she admits that the quite different species which abounds on one stretch of beach, where *Drosera capillaris* Poir. is exceptionally stout and fine, is *R. filifolia*, the first known between southeastern North Carolina and Cape May, New Jersey. We at last had found a pond with real sand-beach. Its shoreline is more than 4 miles around and we followed only one tenth of it. *Rhynchospora filifolia* occurred in but one patch a few rods across, the *Drosera* was more restricted, and we saw only one lonely individual of *Styrax americana*. The remaining shore and visits at intervals up to October should yield great returns. Many species unknown north of the Carolinas delight in such a shore.

On our last day we, inevitably, sought more ponds. Protracted drouth had lowered the water and now was the time to investigate. Driving to Windsor we took a road to Collosse, thence to Darden's Pond. There is a swaley and muddy shore but we got nothing surprising. Next we tried Womble's (on the contour-sheet Wade's) Millpond, which is a drowned cypress-swamp. Sometime, with the aid of a boat, it may yield good things, for *Utricularia inflata* var. *minor* is there; so are great

carpets of *U. biflora*. Our greatest prize, however, was *Carex decomposita*, the rare species heretofore known in the state only in cypress-swamps of the lower James. We then moved on to Whitefield's Millpond, southwest of Corinth, and we regretted that we had not found it in the early morning. This was our last day and twilight was approaching, and we had found another pond with a broad sandy beach. Most of the good things of the other ponds were there and we quickly found a colony of *Hypericum denticulatum* Walt., var. *ovalifolium* (Britt.) Blake, one of the most local plants of the state; then *Viola lanceolata*, var. *vittata* (Greene) Weath. & Grisc. and *Proserpinaca intermedia* Mackenzie, the latter the first from south of the James. At one point I shouted "Look, look!" and promptly got an echo. Long saw it too: a little subprostrate plant with filiform stem, lance-oblong leaves and deep blue glomerules, an *Eryngium* of the *prostratum* group, new to Virginia if not to science. Its immature fruits and its sepals do not well match those of the more southern and western *E. prostratum*. This was the last plant collected and we promised ourselves that in three weeks we should get a real series in ripe fruit. Whitefield's Pond is nearly four miles around. We saw one twentieth of the shore and each of the specialties collected was highly localized. Just as with Airfield and with Johnson's the possibilities are great.

Before leaving Waverly we called on the Chairman of the local Rationing Board and were assured that, when we should return in three weeks, we would be granted the necessary gasoline for continuation of our work, gasoline for trucks used in scientific exploration, as he showed us in the regulations, being unrestricted. It would be necessary, however, to write a letter to the Board who would have to vote on the matter. The letter was promptly sent, with return addressed envelope and an air-mail stamp and I proceeded to make a directory of the more than 100 ponds in Tidewater Virginia, most of which we had never seen. By visiting them all we should find a few as good as Whitefield's, Airfield and the Cat Ponds in northern Isle of Wight. A renewed letter to the local Rationing Board, then one to the State Board, then one from an officer of the federal Experiment Station brought no replies and a considerable collection of uncanceled air-mail stamps was being assembled. Perhaps we

were not merely "damn Yankees". Could it be possible that we were still thought of as "German spies"? In Massachusetts I was assured that, if I would hire and take to Virginia a Massachusetts truck, I could have unlimited gasoline. It seemed, however, an unjustifiable waste of gasoline, as well as tires and time, to travel 1200 miles to and from Waverly in order there to purchase gasoline for 500 miles of local scientific research. We are called disloyal if we do not cheerfully accept all the local and contradictory rulings of OPA. Scientific research is what they choose to dictate and the investigators are those they select. If our work were in Florida or some other state we should not be thus penalized for being scientific investigators.

Professor Massey asked us to guide him to definite stations in Tidewater Virginia for the different species of *Vitis*, *Rubus* and other plants of economic importance and all arrangements were made for our joining forces at Waverly and exploring with his federal truck for the practically useful wild species, including those with edible roots, shoots and seeds and those which might furnish fiber and alcohol. We could also get mature material of the little *Eryngium* and other technically interesting plants. Everything was set for productive field-research when Massey, most unhappily, got himself seriously poisoned and hospitalized by digging and cleaning a lot of bulbs of Fly-poison, *Amianthium Muscaetoxicum*, for experimental study.

In the spring of 1942, Mr. John B. Lewis had sent me from the Seward Forest of the University of Virginia at Triplett in Brunswick County a most extraordinary sterile plant of an *Asarum* which seemed to combine traits of true *Asarum*, with superficial, elongate rhizomes, and § *Heterotropa* (the genus *Hexastylis* Raf.). This was accompanied by an invitation for Long and me to go to the Seward Forest to study it and other problems. Finally, in late August, he sent me from the same area *Hypericum setosum* L., one of the most local of Coastal Plain species in Virginia, and perfectly typical *Cynoctonum sessilifolium* (Walt.) J. F. Gmel., the first evidence in the state of this distinctive species, to quote Small's designation, of "Pinelands and wet places, Coastal Plain, Fla. to La." We already knew that in the Seward Forest there is a small relict stand of Long-leaf Pine, 47 miles west of its concentrated area in south-

eastern Virginia. *Hypericum setosum* and *Cynoctonum sessilifolium*, added to *Pinus palustris*, indicated a probable intrusion of Coastal Plain conditions farther back into the Piedmont of southeastern Brunswick County than the one at McKenney in Dinwiddle County, recorded in RHODORA, xliv. 373 (1942) and on a preceding page in this journal. I promptly wrote Mr. Lewis that, as soon as I could arrange for it, I would go to the Seward Forest. I still hoped (in vain) for at least the courtesy of a reply, pro or con, from the Ration Boards I had repeatedly written, since I knew of so many colleagues with all gasoline needed in various southern states for their scientific explorations.

Finally, on the morning of October 10th, I reached Emporia, to be met there by Mr. Lewis. I had written in advance, suggesting that, before proceeding to Triplett, we drive over to Sedley and have a look at Whitefield's Millpond and collect mature material of the puzzling *Eryngium* and its various companions of October, some of which would certainly be novelties. It seemed, however, that Professor Alfred Akerman, the Director of Seward Forest, wished to see forest-conditions and experimental plantings in Greensville and southern Southampton and had most kindly proposed that we unite errands and spend a long day afield with the Forest truck on the 14th, when I could take a night train, at Emporia, north toward Boston. That plan was so superior to mine that there was no question about it; a few days later we could take the cream from the now abnormally broad sand-beaches of Whitefield's, Airfield and Johnson's Millponds and Long would still more regret that he had been unable to join us.

Seward Forest is a wonderful experimental area for scientific study of forestry and, with very restricted incone, Dr. Akerman and his loyal and underpaid associates are projecting and carrying on invaluable researches. It was a comfort to me to find that this wise and very practical experimenter in forest problems did not have the love of forest fires, as necessary to the stimulation and growth of valuable timber, which is sometimes urged. In fact, the adult trees of Long-leaf Pine, a species which some students claim to need fire if the seedlings are to succeed, have, without that stimulus, successfully planted seeds, and a number of vigorous columns of young trees are there thriving. Most

happily Dr. Akerman did not have the prejudice against botanical research which so frequently blocks our work and, whenever possible, he joined in the local exploration and everywhere found special trees or local tree-species which became the subjects for stimulating discussion. The University of Virginia and the state have invaluable assets in the Seward Forest and in the great capacity and sound common sense of its Director.

Even on the crest, where Long-leaf Pine is successfully renewing itself as a little isolated colony, the rock is mantled by pebbles with rounded sides; and at lower levels the woods and fields are strewn with smoothed and rounded stones and pebbles. This is not what one finds in the ordinary fracturing and frost-heaving of igneous rock. It is most difficult to escape the idea that in this area the old stones and pebbles have been rounded under or by water. The creeks and branches are small and at the lowest levels. In view of the several typical or elsewhere exclusively Coastal Plain species of plants growing there one, who is not a geologist, inclines to the view that an arm of the Miocene Sea must here have intruded back into the Piedmont and that its waters rounded the granitic pebbles and that typical plants, now chiefly of the inner Coastal Plain, subsequently found there the soil-conditions which suit them. At any rate, *Cynoctonum sessilifolium* thrives on a mossy and partially wooded flat; *Hypericum setosum* has recently been found by Mr. Lewis at a second station; *Panicum aciculare of* "Sandy woods and pinelands, Coastal Plain" (*Small*) and *P. lucidum* of "sphagnum bogs, Coastal Plain" (*Small*) abound. In fact, the mingling of Coastal Plain with ordinary Piedmont and even Appalachian Upland plants is very striking. *Panicum aciculare* and the montane *Danthonia compressa* may be collected side-by-side in dry woods. *Kuhnia eupatorioides*, though found in rich woods on the Coastal Plain, is preeminently a plant of the Interior. Near it may be collected the striking *Sorghastrum Elliottii* (Mohr) Nash, here at a new inland limit.

A mile or two up Rattlesnake Creek, west of Triplett, there is a swampy pond-hole in the woods, locally known as the "bog". Here the slightly retarded creek has spread over a flat and, after heavy rain, may become so flooded as to form a considerable pond. One might be in southern Southampton County. The

pool and its margin support several Coastal Plain types, their known ranges here extended 15 to 30 miles inland: *Paspalum fluitans* (Ell.) Kunth (see RHODORA, xxxix. 382, pl. 474, figs. 6–10), *Cyperus densicaespitosus* Mattf. & Kükenth., *Commelina diffusa* Burm. f. (see RHODORA, xlii. 434) and *Hydrolea quadrivalvis*. In dry woods otherwise typical *Andropogon scoparius* has glabrous, instead of densely villous sheaths, and part way up a wooded bluff the northern and upland *Pyrola rotundifolia* var. *americana* has a sterile colony, a plant one would look for in the mountains.

A little mossy swamp-hole, locally known as "Ram-hole" Swamp, because of the ram installed there for pumping water, is largely given over to retarding brambles, but in the mossy thicket there is an abundance of the always beautiful *Lobelia glandulifera* (Gray) Small (see RHODORA, xxxix. 345 and map 20 on p. 343), a species with three geographic centers, (1) from the inner Piedmont of North Carolina across the mountains into Tennessee, (2) several hundred miles to the south, the Coastal Plain of southwestern Georgia and adjacent Florida, and (3) the Coastal Plain of southeastern Virginia and northeastern North Carolina, inland to Amelia and eastern Brunswick Counties. Here it might have been derived either from the southwest or the east; but the goldenrod growing with it may give a clue. Resembling the northern and upland calcicolous *Solidago patula* in having almost wing-angled square stems, it yet is very different. Its technical characters will be defined in Part II. I was delighted to make its acquaintance but somewhat annoyed for, having closed off three different times the treatment of *Solidago*, with 75 species and many cross-references by number for a revised Gray's Manual, I was obliged to interpolate another and to shift the numbering. Nevertheless it is nice to have in Virginia so definite a species as *S. salicina* Ell. It is a fine species of acid bogs of the Coastal Plain and outer Piedmont, described by Stephen Elliott from western Georgia.

One of the finest pieces of hardwood (beech, oak and hickory) in the Seward Forest is back of the old Chamblis place. Here are splendid trees and here Dr. Akerman is carrying on some very productive experiments in forest-reproduction. The soil is deep and, as in all undisturbed beech-oak-hickory forest, full of

interesting upland plants. *Panicum flexile*, a characteristic inland grass, follows the wood-road; and toward the base of one slope there is a bit of the flora of the Blue Ridge or the Alleghenies: *Polygala Senega* var. *latifolia*, *Ligusticum canadense*, and, most surprising of all, the montane *Zizia trifoliata* (Michx.) Fernald in Rhodora, xlii. 298 and pl. 623 (1940), better known as *Z. Bebbii* (Coult. & Rose) Britt.

In an old fallow field back of the Chamblis house there is a large colony, spread evidently by stolons, of a small Leguminous shrub which, Mr. Lewis assured me, never flowers and fruits. It proves to be *Glycyrrhiza lepidota* Nutt., var. *glutinosa* (Nutt.) S. Watson, a rare Licorice from the extreme western side of the United States. It is a large and rapidly increasing remnant of a colony presumably once cultivated. Having, as a boy, chewed licorice-root, I was happy to taste a forgotten nibble, but students now in the university had never even heard of it. One of them returned every few minutes, asking for "a little bit more". I finally had the root firmly glued to the herbarium-sheet!

Hoping for a natural pond-shore, I pushed the inquiry, but the best they could suggest was Simms Millpond, southwest of Fitzhugh, where the dam had gone out some years ago. Proceeding there, we were amazed to see the greatest area of Poke, *Phytolacca americana* (or *decandra*), probably anywhere in existence. The entire drained pond-bottom was a solid, dense thicket of it much higher than our heads. We broke our way into it, hoping for lingering colonies of something more interesting but to no avail. But economically and gastronomically the Poke is interesting and I was surprised to find that it was not being used. The young shoots, as soon as they sprout in early spring, are greatly appreciated as a wholesome and highly nutritious vegetable and are brought regularly to city-markets in many regions, as Charleston, South Carolina, Washington, Baltimore, Philadelphia, etc., as a market-vegetable. The top of the gigantic taproot has a circle of many buds. As soon as the leading shoots are cut others replace them. The leaves alone, from stems up to 3 feet high, are a valuable and delicious potherb, and nothing more tasty, nutritious and quickly cooked could be found than the new stems 2 or 3 feet high, easily rid of the tough rind. *Phytolacca*, only locally appreciated in parts of our country, was

early carried to southern Europe, where it is cultivated for its new shoots. Simms Millpond is locally looked upon as a dead loss. The self-sown crop of tremendously vigorous Poke growing there could feed all Brunswick County for two months in the spring. Tops of the big roots, boxed in earth, frozen, and then placed in a cellar and watered, would supply a green vegetable all winter, and the new shoots from such a God-given truck-farm, sent to an appreciative market, might bring large financial return. The difficulty is to get conservative people to eat what they do not purchase at the corner-market.

Following weeks of unbroken drouth rain came very soon after I reached Seward Forest. It had come to stay and we came in with rain-coats dripping. In the morning of my last day there Dr. Akerman defied the storm and joined Lewis and me on a trip to the Meherrin River, a few miles to the north, above Western Bridge. I specially wanted to see the place because Lewis had collected in flower on the wooded river-bluff the southern *Tiarella* with stout rhizomes, no stolons and very slender racemes. I wanted to secure fruiting material. Trying to dodge the worst downpours, we started up-river in a forest of almost pure growth of *Acer floridanum*, but I very soon worked down to the bottom-land-thicket, for I was attracted by several species there. *Boltonia caroliniana* (Walt.) Fern. in Rhodora, xlii. 487, pl. 642 (1940) was abundant and very tall, though with pink, instead of white ligules, its range extended inland 15 miles or more, and the small-headed *Helenium* was certainly the same as that of the Coastal Plain farther east. We have accumulated so many collections of this *Helenium* from southeastern Virginia that, in desperation, I have tackled the genus. My conclusions will be found in Part II. Vernal and aestival species of this bottom-land were of course unrecognizable, but one leaning and sprawling, very brittle *Muhlenbergia* at once arrested attention. I had just "done" *Muhlenbergia* for the Manual and had attempted to point out more fundamental characters than those commonly used. This one, associated with the common *M. frondosa* (Poir.) Fern. in Rhodora, xlv. 235, pl. 749 and 750 (1943), was none I had seen from the Atlantic slope. Study of its spikelets and comparison in the herbarium shows it to be another prairie species (southwestern Indiana and Illinois to Texas), *M. glabri-*

flora Scribn., isolated, like *M. brachyphylla* (see p. 365) in southeastern Virginia. The lower Meherrin valley begins to compete for honors with the Nottoway. In fact, I now hesitate to make estimates of the relative interest of the isolated or localized floras of the Meherrin, the Nottoway, the Blackwater, and the smaller and sluggish rivers farther east. Each has its specialties. In the aggregate they are a remarkable and still largely unknown flora.

Below the bridge, the steep bluff gave us battered fruit of *Tiarella*. It is so unlike that of the northern *T. cordifolia*, with which it had been placed, as a variety, that in Part II I shall discuss what seem to me its characters and identity. With it were other interesting species and, of course, spring and early summer would yield many more. As notable as any now recognizable were typical *Amsonia Tabernaemontana*, heretofore known in the state only from two stations on the Coastal Plain, and *Scutellaria serrata*, previously unknown in the southern counties east of the Blue Ridge—again the juxtaposition of montane and Coastal Plain specialties.

In the late afternoon, my packing being done, preliminary to a daylight start next morning, I consented to go with Lewis to a little *Cephalanthus*-pool in the woods, which he has dubbed Triplett Pond. Repeatedly, as we drove past it he had gently asked: "Wouldn't you like to look in there?" As regularly, I had declined the invitation. *Cephalanthus*- and *Decodon*-holes rarely yield much, but in this one he had caught small animals which belonged much farther south. I was glad to clear my conscience and to have a look before leaving Seward Forest. On the way, as we passed through dry pine woods, I was surprised to see most characteristic plants of *Gnaphalium obtusifolium* var. *Helleri* (Britt.) Blake, for this very definite variety (see Rhodora, xxxviii. 231, pl. 434, figs. 8 and 9), although originally described from Northwest in southeastern Norfolk County and abundant about Eastville on the Eastern Shore, had never been known inland. Here was an extension inland of 85 miles. The slight inland extension of var. *micradenium* Weath. was negligible and expected. Reaching the little pond-hole, I was amazed to see the coastal *Gratiola virginiana* var. *aestuariorum* Pennell (see Rhodora, xliv. 440, pl. 730, fig. 3). Surely this was no brackish,

tidal shore. But I was diverted by the big clumps of a coarse pilose *Panicum*, which somehow looked familiar but which I could not immediately place; and no wonder, for it is *P. longifolium* var. *pubescens* (Vasey) Fern. in RHODORA, xxxvi. 69 (1934), described by Vasey from Florida and never known north of that state. Lewis knew what he was about when he wanted me to "look in there"; and again I had had rubbed in what we never learn, that in a country with the complex flora of southeastern Virginia every natural spot, no matter how commonplace in aspect, may harbor strongly isolated and local plants.

It was hard to leave the hospitality and stimulating companionship of Dr. and Mrs. Akerman and Mr. and Mrs. Lewis, but next morning in driving rain Akerman, Lewis and I started in the truck for the sand-beaches of ponds in Southampton and Sussex Counties. The forester made his observations and we had a cheerful and interesting trip but, alas, it had rained without letup for five days. When we got to Sedley we were told that we could not get at Whitefield's Pond from the south, for the road was completely under water and the dam itself flooded. That sounded pretty bad and when we reached Whitefield via Corinth, there was the overflowing pond extending back into the woods. The farmer living near by told us that in the forty years he had lived there the water had never been so low as it was until this five-day rain came on. We could have wept. Locating a spot where the little *Eryngium* should be, I walked in to shoulder-depth (I was already drenched by rain), ducked and grabbed. Nothing but floating *Utricularia* and debris came up. The *Eryngium* still evades us. Stopping in Emporia at the home of Lewis's sister and her husband, Dr. and Mrs. George C. Faville (who were sufficiently venerable to have studied botany under the late Professor Charles E. Bessey (1845–1915) in Iowa, but endowed with unlimited alertness and vivacity) and their daughter, Mrs. Wheeldon, I changed to dry clothes and was ready for the all-night ride to New York.

In April Lewis located flowers and young buds on the new *Asarum* and on the 23rd I reached Seward Forest. Restrictions on the use of gasoline had greatly tightened. Lewis had planned to drive to Emporia (18 miles away) for me but the mails had failed to deliver to him my post-card of a week before, saying

when I would arrive. Taxicabs were allowed to cover territory within 10 miles of Emporia and no farther. That distance, fortunately, got me to the Brunswick County line, where I transferred to the taxi of a local farmer who relayed me to Triplett. My home was with one of the foresters and his family, Mr. and Mrs. Howard Nicholson and two delightful little daughters. The fallow fields were carpeted with the vernal weeds and I introduced the family, and especially the children, to the edible qualities, particularly as nibbles and salads, of young Henbit, *Lamium*, and of Peppergrass, *Lepidium virginicum*.

The *Asarum* was locally abundant at the bases of wooded slopes along creeks and branches, great colonies with heart-shaped to slightly halberd-shaped, scattered, solitary firm leaves, but flowers were excessively scarce. In a patch with thousands of leaves there was often not a single bud nor flower; in another patch a few could be found but their peduncles were very fragile and it was difficult to secure a good specimen, showing the thread-like subterranean rhizomes and stolons, without breaking off the flower. Whiteoak Creek and Rattlesnake Creek, investigated at many places, yielded their specimens, and colonies with several young flower-buds were noted, that Lewis might later secure fruit. We here had a very distinct new species and it seemed evident that its rare flowering was a result of its occurrence along creeks and branches where it is often submerged and where its very efficient vegetative reproduction, by slender, subterranean stolons, suffices for its local spread. On the last day, one of the forest-crew having errands in Emporia, we went with him in the truck, in search of this new and very local plant outside Brunswick County. Since both Whiteoak Creek and Rattlesnake Creek are tributary to Fontaine ("Fountain") Creek, the obvious place to look was farther down the latter valley. At our first stop, at the bridge over Fontaine Creek near Barley in southwestern Greensville County, Lewis promptly walked into it; but that seems to be about its eastern limit, not far from the entrance of Rattlesnake into Fontaine Creek. Other crossings of Fontaine Creek did not yield it, although the stretch from the mouth of Rattlesnake Creek to Round Hill Church could not be examined. At Round Hill Church the banks would be forbidding to it, acid sand with *Kalmia latifolia* forming a dense thicket and,

where the white sand is loose and dry, supporting the most beautiful and extensive colony of *Phlox nivalis* I have ever seen. In RHODORA, xlii. 476 (1940) I took up for this plant the unequivocal name, *P. Hentzii* Nutt. (1834) because in the place where he started the name *P. nivalis* Loddiges had given no adequate diagnosis. Subsequently, however, Dr. Wherry, in RHODORA, xliii. 71 (1941), showed that the name given by Loddiges was validated by Sweet in 1827, when a proper diagnosis and fuller description were published. *P. nivalis*, then, has right of way.

The woods along Fontaine Creek lower down, in an area southwest of Dahlia, seemed so like those along Whiteoak and Rattlesnake Creeks that we hopefully went there. As Lewis agreed, it is just the right habitat but no *Asarum* could be found. Subsequently, by saving up his gasoline, Lewis trailed the new species to a small creek in Brunswick County which empties into Roanoke River. How extensively it occurs along Roanoke drainage can be determined only when more gasoline is available. At any rate, this remarkable new species will be described and illustrated (PLATES 774 and 775) in Part II.

Just below Emporia the Meherrin is bordered by a forest composed largely of a yellow-flowered Buckeye. In 1936 Long, Griscom and I had got a little of it in woods along Metcalf Branch, which enters the Meherrin a mile farther down; and in RHODORA, xxxix. 352 and 435 (1937) and xl. 441 (1938) I erroneously recorded it as *Aesculus discolor* Pursh, a more western species. The freshly flowering material secured from the extensive forest of the tree shows it to be *Ae. neglectus* Lindl., var. *pubescens* Sargent. It was a novel experience to wander in such a forest on the inner edge of the Coastal Plain. Whereas at Triplett, only 18 miles to the west and with creeks at barely 100 feet greater elevation, spring was just emerging, here it was almost summer. *Corydalis flavula*, which we had known on the Coastal Plain of southeastern Virginia only along the James and its tributaries was scattering seed; the fruits of *Nemophila microcalyx* and of *Viola striata* (also James River specialties) were ripe. Great carpets of *Phacelia dubia* had enough lingering flowers to be handsome and, surprise of surprises, here were thousands of plants, now passing out of bloom, of upland and inland *Trillium*

sessile, the first member of its genus I had ever seen growing in southeastern Virginia. There was no time to linger. These and a few other species were tucked into a portfolio and I hurried to catch the night train northward, hoping that some "break" would soon get Long and me to this botanically unexplored and most distinctive area of the Meherrin at the inner margin of the Coastal Plain. At least, I could get another and longer visit there when, a few weeks later, I should return to Seward Forest to follow up *Rubus*, which there seems to be a series somewhat different from that of the Coastal Plain. When I regretfully said good-by to Lewis and with forty people boarded the north-bound train at Emporia, the now familiar announcement of the Conductor reached my ears, "No seats. Standing room only." On the platform of the car, however, there were two square feet of space, where someone had moved. Setting my suitcase on end and placing the portfolio of fresh specimens across it, I had a seat, such as it was, all the way to Washington, where the train decided to make over before proceeding to New York. Three hours wait in a milling throng outside the train-gate from 1 to 4 A. M. was finally relieved by announcement of a train to New York. Such, inevitably, is travel in war-time. There has been no opportunity for another trip, gasoline-rationing having still further tightened; but, in spite of varied and discouraging obstacles, something has been done to keep the flame of botanical exploration burning. The results, more briefly summarized in Part II, are not discreditable. Beginning the Virginia work with three days in the field in 1933, continuing with two to five trips a season for nine years and making but one brief trip, as a guest of the Seward Forest, in April of 1943, we are assembling much substantial data on the flora of the state. In the last report on this work[1] the records of vascular plants new to Virginia, recorded in this series of papers, reached 751. When and if we are again able to renew the exploration the score of novelties to the state can begin the ninth century.

[1] *The Seventh Century of Additions to the Flora of Virginia*, Rhodora, xliv. 341–405, 416–452, 457–478 and plates 717–744—Contrib. Gray Herb. no. CXLV (1942).

Part II. Range-extensions, Technical Notes and Revisions

In Part II, as in previous papers of this series, the notes covering extensions of range are assembled, even though the species has been discussed in the more discursive journal. Several species collected by others and detected in the Gray Herbarium during studies recently prosecuted, or some sent by others, are included if I can find no record of their occurrence in the state. A number of detailed and critical studies are also included since they have grown out of comparisons of our Virginia material or since they deal with genera occurring in the state. The many plates were prepared by Dr. Bernice G. Schubert, to whose skill and patience I am under great obligation. The cost of engraver's blocks has been covered from a grant for personal research from the Department of Biology of Harvard University. As so frequently in the past, Mr. Long has most generously aided in meeting the expense of publication.

As heretofore, plants thought to be previously unlisted from Virginia or only recently recorded in technical studies of groups are indicated by an asterisk (*). In the enumerations the names of the collectors, when Fernald & Long, are generally omitted.

*Potamogeton epihydrus Raf., var. Nuttallii (Cham. & Schlecht.) Fern. × P. pulcher Tuckerm. Isle of Wight County: forming an extensive carpet, outlet of Lee's Millpond, no. 12,230. See Ogden in Rhodora, xlv. 184 (1943). The only known occurrence of this hybrid. See also Rhodora, xliii. 508 and 519 (1941).

*Danthonia spicata (L.) Beauv., var. longipila Scribn. & Merr. See Fernald in Rhodora, xlv. 244 (1943), where several Virginia collections are cited.

D. compressa Aust. See Fernald, l. c. A northern and upland species occurring only locally in the southeastern counties: Surry County: rich calcareous wooded slopes along James River, Claremont Wharf, no. 9825. Brunswick County: oak-hickory-beech woods back of old Chamblis Place, Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,458. See p. 376.

*Muhlenbergia glabriflora Scribn. Brunswick County: exsiccated bottomland woods above Western Bridge, Meherrin River, south of Edgerton, *Fernald & Lewis*, no. 14,460. The first station known from east of the Mississippi Basin (southwestern Indiana and Illinois to eastern Texas). See p. 379.

Digitaria serotina (Walt.) Michx. To the single recorded

Virginia station add another, also in Southampton County: sandy shore of Johnson's Millpond, 1½ miles north of Sedley, no. 14,265. See p. 371.

Paspalum dissectum L. To the few recorded stations add one in Sussex County: sandy shore, Airfield Millpond, southwest of Wakefield, no. 14,264. See p. 372.

P. fluitans (Ell.) Kunth. See Rhodora, xxxix. 282, t. 474, figs. 6–13 (1937). Local range extended into Brunswick County: swampy pond-hole in woods, Rattlesnake Creek, west of Triplett, *Fernald & Lewis*, no. 14,462. See p. 377.

Panicum flexile (Gattinger) Scribn. Brunswick County: clearing in oak-hickory-beech woods back of old Chamblis Place, Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,471. Cited by Hitchcock & Chase only from Alexandria County. See p. 378.

*P. longifolium Torr., var. pubescens (Vasey) Fernald in Rhodora xxxvi. 69 (1934). Brunswick County: sphagnous knolls in woods by Triplett Pond, Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,472. First from north of Florida. See p. 381.

P. aciculare Desv. Local range extended inland to Brunswick County: dry border of oak-hickory-beech woods back of Chamblis Place, Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,466. See p. 376.

P. Wrightianum Scribn. Several additional stations on pond shores. Sussex County: Brittle's Millpond, west of Wakefield, no. 14,267; Airfield Millpond, southwest of Wakefield, no. 14,268. Southampton County: Johnson's Millpond, 1½ miles north of Sedley, no. 14,266; Whitefield's Millpond, southwest of Corinth, no. 14,270. Isle of Wight County: Darden's Pond, southeast of Collosse, no. 14,269. See pp. 371 and 372.

P. auburne Ashe. To the few recorded stations add one in Isle of Wight County: dry sandy pine barrens, south of Zuni, no. 14,275.

P. sphaerocarpon Ell., var. inflatum (Scribn. & Sm.) Hitchcock. In disturbed soil in wet woods along Assamoosick Swamp, northeast of Homeville, Sussex County, the stimulated plants reach a height of 1 m. with leaves up to 1.6 dm. long and 1.5 cm. broad, the panicles 1.5 dm. long and 1 dm. broad. The extreme height given by Hitchcock & Chase for the species is 5.5 dm., with panicles up to 1 dm. long.

*P. tenue Muhl. Westmoreland County: open, sandy pine woods, Colonial Beach, *F. T. Hubbard*, no. 413, as *P. ensifolium*. Not recorded from north of North Carolina.

P. mundum Fernald in Rhodora, xxxviii. 392, t. 443, figs. 1–5 (1936). To the few recorded stations add one in Norfolk County: sphagnous pocket, upper border of fresh reed-marsh and swale along Northwest River near Northwest, no. 14,272.

*Setaria verticillata (L.) Beauv. Rockbridge County: along sidewalk, Lexington, August 23, 1924, *J. R. Churchill.*—Not indicated for Virginia on Hitchcock's map 1567 (*Man.*).

The common northern Burgrass.—The common Burgrass of open sands, from New Hampshire to Oregon, south to North Carolina, Kentucky, Missouri, Kansas and New Mexico, is indigenous or spread from indigenous colonies through much of this range but, singularly enough, it has always passed under specific names which technically belong to other species. Long identified as *Cenchrus echinatus* L., it was forced to resign that name to the quite different tropical species. Similarly the name *C. tribuloides* L. soon proved to belong to the very coarse tropical and southern coastal species. Then *C. carolinianus* Walt. was despairingly grasped, but Walter's type is unknown, our plant is doubtfully in his territory, and Mrs. Chase, Contrib. U. S. Nat. Herb. xxii. 76 (1920), believes that *C. carolinianus* might have been *C. incertus* M. A. Curtis, which does grow in Walter's country. In her monograph of the genus she merges our plant with the Mexican *C. pauciflorus* Benth. and, until Dr. I. M. Johnston, working upon his Mexican and southern Texan material, segregated it off from the great bulk of specimens from the northern and Rocky Mountain region of the United States, it so rested. Dr. Johnston, not wishing to get involved with the more northern and northeastern plant, called the matter to my attention. There is no doubt that *C. pauciflorus* is the Mexican (and Texan) species, Bentham having described it from Lower California: "culmis suberectis, . . . Folia plerumque angustiora [quam in *C. echinata*], spinis dorsalibus marginalibusque validis basi dilatatis".

Cenchrus pauciflorus, then, is the Mexican and Texan species with culms usually in erect or ascending tufts, the leaves 1.5–4 mm. broad, the summit of the sheath spreading as a chartaceous flange; spikes 1–5 cm. long, 1–1.5 cm. thick; the stramineous involucres 8–12 mm. broad (from tip to tip of mature spines), the dorsal and lateral spines compressed and broad-based. The characteristic fruit, from the type of *C. pauciflorus*, is shown by Mrs. Chase, l. c. fig. 17, p. 68.

Our plant, on the other hand, has more generally decumbent or rooting culms, up to 8 dm. long and strongly geniculate;

leaves 3–8 mm. broad, the enlarged sheaths constricted at summit; spike 1.5–8 cm. long and 1.3–2 cm. thick, the mature stramineous to bronze or purplish burs 1–1.5 cm. in diameter, with the coarse spines subulate-subterete. The bur is beautifully shown, as that of *C. pauciflorus*, in Chase, l. c. 69, fig. 18, and this figure, instead of that of true *C. pauciflorus*, was copied in Hitchcock, Man. fig. 1594. As compared with that of real *C. pauciflorus* it is too large, with more numerous spines, the stronger ones more slender and without deltoid and flattened bases.

So far as I can find the only available name for the northern and transcontinental species is *C. echinatus*, forma *longispinus* Hackel, based upon Connecticut material collected by Harger and distributed by Kneucker (no. 426). As a diagnosis of a form of *C. echinatus*, in the loose sense, Hackel's brief description was sufficient. Treated as a species the plant demands a fuller account. It is fortunate that Hackel has supplied the basonym and type. Even so, I take no comfort in having even my name intimately associated with a *Cenchrus* and the keen taxonomist who called it to my attention would not care to have the species named for him!

Cenchrus **longispinus** (Hackel), stat. nov. *C. echinatus*, forma *longispinus* Hackel in Kneucker, Allg. Bot. Zeitschr. ix. 169 (1903). Planta annua; culmis decumbentibus vel adscendentibus ad 8 dm. longis geniculatis basi ramosis; foliis 3–8 mm. latis, vaginis distentis apice constrictis; spicis maturis 1.5–8 cm. longis 1.3–2 cm. crassis; involucris maturis stramineis vel aeneis vel purpurascentibus hirsutis 1–1.5 cm. diametro, spinulis majoribus tereti-subulatis. Type of *C. echinatus*, forma *longispinus:* Oxford, Connecticut, *E. B. Harger* in Kneucker, Gram. Exsicc. Lief. XV. no. 426.

In southeastern Virginia, fortunately, *Cenchrus longispinus* is rare. Our only collections are the following. James City County: sandy field about 5 miles west of Toano, *R. W. Menzel*, no. 187. Southampton County: dry white sand of clearing in oak and pine woods bordering Assamoosick Swamp, south of Sebrell, no. 10,941; grassy roadside about 7 miles south of Franklin, no. 7297 (misidentified as *C. incertus*).

Erianthus coarctatus Fernald in Rhodora, xlv. 246, t. 758 (1943). Note that the plant of Sussex County previously reported as *E. brevibarbis* Michx. belongs here. *E. brevibarbis* is a very different plant of the Mississippi Basin.

*Eulalia viminea (Trin.) Ktze., var. variabilis Ktze. *Pollinia imberbis* Nees, var. *genuina* Hackel, Andropogoneae in DC. Mon. vi. 178 (1889). Greensville County: roadside bordering rich woods by Three Creek, northwest of Emporia, nos. 12,564 and 13,883.

When, in Rhodora, xliii. 518 and 536, I reported *Eulalia viminea* (no. 12,564) from Greensville County we had not yet got the flowers. The later collection (no. 13,883), made October 13, 1941, shows the plant to be var. *variabilis*, which is characterized by having delicate awns up to 9 mm. long. Blake's plant, collected along the James River at City Point, near Hopewell in October, 1931 (*Blake*, no. 11,472) is of typical *E. viminea* (i. e. *Pollinia imberbis*, var. *Willdenowiana* (Nees) Hackel), with awnless spikelets. Typical *E. viminea* occurs southward to Alabama: shaded bank of Tennessee River, northeast of Sheffield, Colbert Co., Oct. 7, 1934, *Harper*, no. 3275.

The earliest valid generic name for the genus is *Eulalia* Kunth, Rév. Gram. i. 160, t. 93 (1829), although Hackel, like most Old World botanists, has maintained *Pollinia* Trin. in Mém. Acad. Pétersb. ser. VI. ii. 304 (1833). In so doing they may have been misled by Index Kewensis, which lists just before *Pollinia* Trin. another *Pollinia* Spreng. Pugill. ii. 10 (1815), "farrago [mixture] = seq. &c." The "&c" is correct, for Sprengel had 10 species, none of them considered by Hackel as belonging in *Pollinia* Trin.: 6 referred by Hackel directly to *Andropogon;* 1 to *Oplismenus;* 1 to *Ischaemum;* and 2 wholly doubtful "species inextricabiles" (Hackel, l. c. 565). *Pollinia* Trin. (1833), clearly antedated by *Eulalia* Kunth (1829), must lapse.

In looking up the origin of the generic name *Eulalia* the quickest method was to turn to the shelf of dictionaries and to see what Wittstein said in his Etymologisch-botanisches Handwörterbuch. There it is: "**Eulālia** knth. (*Gramineae*). Zus. aus εύ (schön, gut) und λαλια (Rede, Gericht, Ruf); ein schönes, guldgelbblühendes Gras". The type of the genus being *E. aurea* Kunth, that derivation is plausible. Had Wittstein taken the trouble to look up Kunth's own explanation, however, he would have found a more pleasing and splendidly appropriate explanation of the name, for it is difficult to imagine more beautiful illustrations (all signed E. D.) than the 220 wonderful plates

by Eulalia Delile which clarify Kunth's remarkable volumes. That Kunth was fully appreciative of his artist is made clear by his own explanation: "Dixi hoc genus in honorem Eulaliae Delile, cujus perito elegantique penicillo icones hujus operis ut et quorumdam aliorum debet botanice".

*Andropogon scoparius Michx., var. genuinus Fern. & Grisc. in Rhodora, xxxvii. 143, 144 (1935), forma **calvescens,** f. nov., vaginis glabris. Virginia: dry woods along Rattlesnake Creek, west of Triplett, Brunswick County, October 11, 1942, *Fernald & Lewis*, no. 14,474 (type in Herb. Gray.; isotype in Herb. Phil. Acad.); moist sandy and peaty pine barrens, south of Lee's Mill, Isle of Wight County, August 23 and September 2, 1940, *Fernald & Long*, no. 12,567. See p. 377.—Quite like typical *Andropogon scoparius* (= var. *villosissimus* Kearney) but with the sheaths glabrous instead of densely villous.

Sorghastrum Elliottii (Mohr) Nash. Local range extended inland to Brunswick County: dry woods along Rattlesnake Creek, west of Triplett, *Fernald & Lewis*, no. 14,473. See p. 376.

Bulbostylis ciliatifolius (Ell.) Fern. New northeastern extensions. Isle of Wight County: dry sandy pine barrens south of Zuni, no. 14,283. Southampton County: dry sand of open alluvial flat by Blackwater River, southeast of Unity, no. 14,284. See p. 369.

*Scirpus subterminalis Torr. Princess Anne County: shallow water, northwest branch of Salt Pond, June 28, 1922, *L. F. & Fannie R. Randolph.*

Although Britton, Ill. Fl., cites *Scirpus subterminalis* as extending south to South Carolina and Small, Man. 169, says "Miss.", I have been unable to locate previous material from south of New Jersey and Pennsylvania. There is nothing in the Gray Herbarium nor in the Britton Herbarium from south of New Jersey and Pennsylvania, except the Salt Pond specimen; and the rather extensive collecting in eastern South Carolina and eastern North Carolina by Godfrey did not bring it to light. Beetle, however, in Am. Journ. Bot. xxx. 396 (1943) seems to have seen material from both South Carolina and Mississippi.

The Specific Characters of Scirpus Olneyi—One of the most distinctive species of *Scirpus*, § *Schoenoplectus*, is the coarse, soft-stemmed *S. Olneyi* Gray (1845), which follows saline and brackish marshes from eastern South America up the Atlantic to southern New Hampshire and Nova Scotia, the Pacific to Washington. In many characters the plant is so

distinctive that amateurs who do not distinguish between some technical species usually recognize this one at a glance. It is, therefore, a bit startling to find in the Am. Journ. Bot. xxx. 397 (1943) Beetle merging it with and reducing it to *S. chilensis* Nees & Meyen (1843). Beetle's detailed description of the inclusive species, as *S. chilensis*, clearly says "style 2-fid", which is correct for the tropical and North American *S. Olneyi*, and in his discussion he speaks of the original diagnosis of *S. chilensis* as "adequate to identify the plant". He then quotes the diagnosis of *S. chilensis*, including the original and easily corroborated "stylo trifido"; but he gives no explanation of how a plant of the warmer half of the Northern Hemisphere with "style 2-fid" is necessarily, or even probably, identical with a plant of temperate South America with "stylo trifido". This distinction is constant, apparently. So are several others. The broadly wing-angled soft culm of *S. Olneyi* is so very soft that in pressing it becomes flat and ribbonlike; in fresh condition, however, it has deep reëntrant angles which caused Asa Gray, in originally describing it, to give the following vivid description: "distinguished by its remarkably 3-winged stem. The reëntering angles are so deep that the cross section presents the appearance of three rays, or plates with parallel sides, joined by a common center." The collapsing of the culm under very slight pressure results from its hollow or fistulous character, the pith occurring as scattered remnants only. If *S. Olneyi* is identical with *S. chilensis* it is notable that the much more slender culms of the latter are firm and resistant, not flattened in drying, that they lack the extremely broad wing-angles and deep reëntrant concavities and that they are closely filled with pith.

In *S. Olneyi* the upper leaf-sheaths have a U- or V-shaped orifice and the brown tissue of the sheath-summit is readily friable; in *S. chilensis* the orifice is subtruncate or very shallowly concave and the tissue firmer. In *S. chilensis* the excurrent midribs of the scales project more prominently than in *S. Olneyi*. In *S. chilensis*, as already noted, there are 3 style-branches, in *S. Olneyi* 2. Although the achenes of the bipartite *S. chilensis* sensu Beetle are given absolute dimensions, "2.5 mm. long, 1.5 mm. broad", the few achenes of *S. chilensis* available, from *Pennell*, no. 12,923 and *Osten*, no. 22,029, are definitely more

slender than in *S. Olneyi*. These two numbers of *S. chilensis* have achenes narrowly obovate and three fifths to three fourths as broad as long: 2.6 × 1.8 mm., 2.4 × 1.8 mm., 2.3 × 1.5 mm. On the other hand, ripe fruit from material of *S. Olneyi* from the general type-region, southern New Hampshire to Virginia, shows much more rounded or broadly obovate achenes four fifths as broad to essentially as broad as long: 2.2 × 1.8 mm., 2.2 × 2 mm.; 2.4 × 2.2 mm., 2 × 1.8 mm., 2 × 1.6 mm., etc. Whether or not typical *S. Olneyi* occurs in temperate South America I am not situated to determine. Barros & Osten described a *S. Olneyi*, forma *australis* from Uruguay in Anal. Mus. Hist. Nat. Montevid. ser. 2, iii. 204 (1931) and in vol. xxxviii. 159 and 161 (1935) Barros illustrated it and cited much material from Argentina but did not suggest that it includes *S. chilensis*. In fact, in the latter detailed study Barros definitely cited (p. 156) *S. chilensis* as identical with *S. americanus* Pers. I am content to keep up *Scirpus Olneyi* as a thoroughly distinct species.

In Virginia *Scirpus Olneyi* makes extensive colonies often 2 m. or more high, on the saline and brackish shores.

*S. VALIDUS Vahl, var. CREBER Fern., forma MEGASTACHYUS Fernald in RHODORA, xlv. 283, t. 765, fig. 8 (1943). JAMES CITY COUNTY: marsh of Chickahominy River about 5 miles west of Toano, *R. W. Menzel*, no. 89.

*S. ETUBERCULATUS (Steud.) Ktze. PRINCESS ANNE COUNTY: shallow water, northwest branch of Salt Pond, June 29, 1922, *L. F. & Fannie R. Randolph*, no. 462.

Scirpus etuberculatus, one of the most localized of species, has a long-known station near Salisbury, Maryland, one or two in southeastern North Carolina, two in Georgia, one in Florida, two in Alabama, one in Mississippi, and one in Louisiana. The station of Mr. and Mrs. Randolph is apparently the first between southeastern North Carolina and Salisbury, Maryland.

*S. ROBUSTUS Pursh, forma **protrusus,** f. nov., spiculis plus minusve elongatis ad 3–5 cm. longis.—VIRGINIA: brackish to fresh marsh along Back Bay, at eastern margin of Long Island, Princess Anne County, August 25, 1939, *Fernald & Long*, no. 10,973 (TYPE in Herb. Gray., isotype in Herb. Phil. Acad.); border of salt marsh, Ragged Island, northeast of Carrollton, Isle of Wight County, August 20, 1940, *Fernald & Long*, no. 12,587.—Differing from typical *S. robustus* (with spikelets 1.3–3 cm. long) by its very prolonged spikelets.

Photo. B. G. Schubert.

LILIUM CANADENSE: FIGS. 1 and 2, × 1; Var. EDITORUM: FIGS. 3–5, × 1

Photo. B. G. Schubert.

TRILLIUM PUSILLUM, × 1: FIG. 1, Michaux's TYPE, after photo. by *Cintract;* FIGS. 2 and 3, modern specimens from type-region, FIG. 2 with short anthers, FIG. 3 with long anthers

S. MARITIMUS L., var. FERNALDI (Britton) Beetle. See Fern. in RHODORA, xlv. 289 (1943). *S. novae-angliae* Britton. Our only collections are from the James River or its tributary creeks. SURRY COUNTY: tidal marsh at mouth of Crouch Creek, east of Scotland, no. 8593, previously reported as *S. novae-angliae*. JAMES CITY COUNTY: tidal shore of Back River, opposite Jamestown Island, no. 10,972, distrib. as *S. robustus* Pursh.

*S. MARITIMUS, var. FERNALDI, forma AGONUS Fern. l. c. 288 (1943). NEW KENT COUNTY: fresh tidal marsh by Lacey Creek, west of Walker, no. 13,559.

*RHYNCHOSPORA FILIFOLIA Gray. SUSSEX COUNTY: upper border of siliceous and argillaceous shore, Airfield Millpond, southwest of Wakefield, no. 14,301. First station between southeastern North Carolina and Cape May, New Jersey. See p. 372.

CAREX DECOMPOSITA Muhl. To the three recorded stations add one in SOUTHAMPTON COUNTY: margin of cypress swamp bordering Womble's (or Wade's) Millpond, north of Baffle, no. 14,305. See p. 373.

C. BAYARDI Fern. *C. virginiana* Fern., not Woods. Range extended northwestward in SOUTHAMPTON COUNTY: sandy alluvial bottomlands of Three Creek, Adams Grove, no. 14,306. See p. 367.

C. VENUSTA Dewey. To the few recorded stations add one in DINWIDDIE COUNTY: wet springy sphagnous woods east of Cherry Hill, no. 14,307. See p. 367.

C. COLLINSII Nutt. To the few recorded stations add one in DINWIDDIE COUNTY: wet springy sphagnous woods east of Cherry Hill, no. 14,311. See p. 366.

COMMELINA DIFFUSA Burm. f. Local range extended inland to BRUNSWICK COUNTY: swampy pond-hole in woods, Rattlesnake Creek, west of Triplett, *Fernald & Lewis*, no. 14, 478. See p. 377.

AMIANTHIUM MUSCAETOXICUM (Walt.) Gray. Local range extended northward in ISLE OF WIGHT COUNTY: clearing in damp sandy pine barrens south of Zuni, no. 14,315. See p. 369.

NOTHOSCORDUM BIVALVE (L.) Britt. Range extended inland from Princess Anne and Northampton Counties: JAMES CITY COUNTY: turf back of beach and disturbed soil in woods and thickets back of sand-beach of James River, Martin's Beach, southeast of Grove, *Fernald, Long & Abbe*, nos. 14,128 and 14,129. ISLE OF WIGHT COUNTY: turf back of sand-beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), *Fernald, Long & Abbe*, no. 14,127. See pp. 360, 364.

*LILIUM CANADENSE L., var. **editorum,**[1] var. nov. (TAB. 771, FIG. 3–5), a var. typico recedit foliis mediis ellipticis vel oblongis acutis vel subacutis, vix attenuatis, latitudine ⅕–½ partem

[1] ***Editorum*** **(of the uplands) from** ***editum*****, upland or a height; not from** ***editor!***

longitudinis aequante; floribus rufescentibus; perianthii tubo elongato, tepalis supra medium sensim arcuatis; petalis (siccis) 0.8–1.3 cm. latis.—Locally from the mountains and the Allegheny Plateau of Pennsylvania to Kentucky and the mountains of Alabama. Pennsylvania: Waddle, Center County, July 3, 1939, *J. P. Kelly;* thickets along Conoquenessing Creek, Butler County, July 17, 1932, *John Bright*, no. 6789. Ohio: Columbus, 1837, *Lesquereux?* West Virginia: swale near Cacapon River, Hampshire County, July 1, 1933, *Hunnewell*, no. 12,771. Virginia: open mountain-meadow at about 4000 feet alt., top of Butt Mountain and at about 3500 feet alt. near Little Stony Creek near "Cascade Road", Giles County, July 24, 1943, *A. B. Massey*, no. 4617 (type in Herb. Gray.); meadow, Virginia Hot Springs, Bath County, July 5, 1917, *Hunnewell*, no. 4824; woods at 2700 feet alt., Shenandoah Mt., Rockingham County, July 14, 1932, *Hunnewell*, no. 12,481. Kentucky: swampy meadows, 2 miles south of London, Laurel County, July 4, 1939, *McFarland*, no. 3545; oak-chestnut mountain-summit forest, at 4000 feet alt., Black Mt., Harlan County, July 22, 1937, *E. Lucy Braun*, distrib. as *L. canadense* or *L. michiganense*. Alabama: rich woods on limestone, north slope of Monte Saho, Madison County, June 22, 1932, *T. S. Van Aller.*

Freshly collected material of *Lilium canadense* var. *editorum* reached me just as this Contribution was starting to the printer, Professor Massey sending it with a query as to its real identity. Typical northern *Lilium canadense*, described from Canada and occurring from the Gaspé Peninsula of Quebec to northeastern Ohio, south to Nova Scotia, New England, Pennsylvania and upland to western Virginia, has the lanceolate (narrowly to broadly) leaves of the median whorls attenuate to acute tips, the blades $\frac{1}{10}$–$\frac{1}{5}$ as broad as long, the usually yellow flower (red only in the rare forma *rubrum* Britt.) with relatively short and thick tube, the tepals strongly arching (fig. 1) from below or near the middle, the petals 1.2–2 cm. broad. Occasional specimens have the leaves of var. *editorum* but the flower of typical *L. canadense*. Such a transitional series is represented by *MacDaniels & Thomas*, no. 3710 from Ithaca, New York. It is noteworthy, then, that Ithaca is near the northern border of the Allegheny Plateau as mapped by Fenneman.

The chief points of departure of var. *editorum* are its relatively broad and only slightly if at all tapering leaves, its red flower with slender and elongate tube, so that the arching of the tepals

starts near or above the middle, and the narrow tepals, the petals in dried specimens being only 0.8–1.3 cm. broad. One collection before me, *C. E. Wood, Jr.*, no. 1365, from sedge-meadow, Little Meadows, northwest of Mountain Lake, Giles County, Virginia, has the leaves narrower than and as attenuate as in the most extreme northern plant, with flowers nearly of var. *editorum*.

A number of the above cited specimens were sent to the Gray Herbarium with indications of doubt as to the identity and usually with note of the red flower. The *Bright* material from Butler County was marked in the hand of a temporary assistant "*Lilium michiganense*", while the *McFarland* specimen was identified with doubt as *L. canadense*, and the old sheet from Columbus, Ohio, originally identified as *L. canadense*, bears modern annotations, first as *L. superbum* L., later as *L. michiganense* Farw. Until Professor Massey sent his material the question of an undescribed montane variety had not been considered. The accumulated discontent with the identification of the plant lead to its more critical study.

When we know ripe fruit of *Lilium canadense*, var. *editorum* the seeds may show some further differences. The ripe fruit of typical northern *L. canadense* is well represented in the collections before me, by 19 numbers in fully mature fruit, collected in eastern Canada and interior New England, north or inland from the coastwise northern limit of *L. superbum* and far east of the quite different inland *L. michiganense* Farw. The fully developed seeds of *L. canadense* vary from 7–11 mm. long, mostly 9–10 mm. It is hoped that mature fruit of the montane plant may soon be available.

The frequent misidentification of *Lilium canadense*, var. *editorum* as the eastern and southern *L. superbum* or as the midland *L. michiganense* reflects dissatisfaction with its being called simply the northeastern *L. canadense* but it also indicates lack of understanding of the morphological characters which separate *L. michiganense* and *L. superbum* from one another and both of them from *L. canadense*.

In PLATE 771, FIG. 1 is typical LILIUM CANADENSE from Lexington, Massachusetts, painting by the late *Elsie Louise Shaw;* FIG. 2, characteristic leaves from Shelburne, New Hampshire, July 30, 1924, *Walter Deane*. FIGS. 3–5, var. EDITORUM: FIGS. 3 and 4, flower and median leaves from TYPE; FIG. 5, flower from Butler County, Pennsylvania, *John Bright*, no. 6789. All figs. × 1.

Trillium sessile L. Greensville County: rich woods along Meherrin River, below Emporia, *Fernald & Lewis*, no. 14,530, very abundant. Our first record from the Coastal Plain. See p. 383.

The Dwarf Trillium of Southeastern Virginia (Plates 772 and 773).—In southeastern Virginia the genus *Trillium* is so very local and scarce that in ten seasons of field-work I had never met any member of the genus there growing wild until Mr. Lewis and I came upon the extensive colony of *T. sessile* above noted. I had, however, reported in Rhodora, xlii. 445 (1940) the occurrence in the Great Dismal Swamp of a plant which I then misidentified as *T. lanceolatum* Boykin; Professor Smart had told me of the occurrence near the University of Richmond of a scarce plant thought to be *T. pusillum* Michx., this discovered in May, 1931; and in the Gray Herbarium there is, under *T. pusillum*, a sheet of exactly similar material from near Powhatan Creek in James City County, discovered by *Mrs. W. G. Guy* and *Dr. Stetson*, also in early May, 1931, and sent to the Gray Herbarium by Professor Warren. Furthermore, Mr. Lewis told me of a station in Dinwiddie County which had been shown to Mrs. Laura H. Lippitt by the friend who had discovered it. From this station, rich loamy woods near a stream in company of Royal Fern, Sensitive Fern and Lady-fern and *Medeola* (a very frequent association), Mrs. Lippitt has sent me a beautiful series of freshly flowering specimens, with the note that the petals are white, turning pink and then dark purple.

Altogether, the dwarf *Trillium* has a considerable, though highly localized, occurrence in the southeastern counties of Virginia; and, in identifying the Meherrin River *T. sessile*, it became quite apparent that the tiny plant is all of one distinctive species and that it is neither *T. lanceolatum* nor typical *T. pusillum*. The latter, *T. pusillum* Michx. (plate 772), was described as having the leaves sessile, the flower peduncled and erect, the sepals scarcely longer than the petals, the petals pale flesh-color; and it came from pinelands of South Carolina. The Michaux material (our fig. 1) well agrees with this description and the label gives the further information: "35 m. de Charlest. environ Gaillard road". Just such a plant, figs. 2 and 3, is known from eastern South Carolina. It has the flower long-peduncled, the

Photo. B. G. Schubert.

TRILLIUM PUSILLUM var. VIRGINIANUM, TYPE, × 1: FIG. 1 with long anthers, FIG. 2 with short anthers

T. LANCEOLATUM, × 1: FIG. 3, summit of flowering plant

Photo. B. G. Schubert.

ASARUM LEWISII, from TYPE-series: FIG. 1, two plants, × 1½; FIG. 2, expanded flower, × 3

petals about equaling or even longer than the sepals, 1.8–2.5 cm. long and 4–9 mm. broad; the anthers sometimes 5–6 mm. long, definitely longer than the filaments, or in otherwise typical South Carolina plants only 3 mm. long and definitely shorter than the filaments. The plant of southeastern Virginia (PLATE 773, FIGS. 1 and 2) looks like *T. pusillum*, but its flowers are sessile or elevated on a peduncle up to only 5 mm. long. If the latter embarrassing individuals are excluded, it is one of the "sessile-flowered" species; if they are taken into account it is a species with peduncled ("pediceled") flowers, a bit awkward in key-making. Its petals are mostly shorter than the sepals, 1.2–2 cm. long and 3–5 mm. wide, the anthers 3–8 mm. long and only slightly if at all longer than the filaments.

In view of the inconstancy in length of anthers and the overlaps in other characters I am treating the plant of Virginia as a geographic variety of *Trillium pusillum*, rather than as a distinct species. The sessile flowers of most Virginia material were responsible for one collection being placed with *T. lanceolatum*. That more southern species, however, has the sepals soon reflexed and the long and tapering petals (our PLATE 773, FIG. 3) with slender claw-like bases. The Virginia plant is

TRILLIUM PUSILLUM Michx., var. **virginianum,** var. nov. (TAB. 773, FIG. 1 et 2), a var. typicum recedit flore sessile vel subsessile; petalis 1.2–2 cm. longis 3–5 mm. latis, antheris 3–8 mm. longis.—Southeastern VIRGINIA: Henrico County: damp woods north of Westwood Golf Course, May 8, 1931, *R. F. Smart & Elmer C. Pritchard* (Herb. Univ. of Richmond); woodland north of University Road, Westwood, May 8, 1931, *Mary E. Billings*. JAMES CITY COUNTY: Long Hill Swamp, Powhatan Creek on Centreville Road west of Williamsburg, discovered by *Mrs. W. G. Guy and Dr. Stetson*, coll. May 3, 1931, by *Paul A. Warren*. NORFOLK COUNTY: Great Dismal Swamp, west of Wallaceton, April 24, 1926, *Paul A. Warren*, no. 413. DINWIDDIE COUNTY: rich loamy woods near stream, 5 miles east of Dinwiddie Court House, May 9, 1943, *Laura H. Lippitt* (TYPE in Herb. Gray.).

In view of the evident dimorphism as to length of anthers in both typical *Trillium pusillum* and its var. *virginianum*, it is evident that too much weight has been placed upon the length of anthers in the group. See p. 364.

PLATE 772 is of TRILLIUM PUSILLUM Michx., × 1: FIG. 1, Michaux's TYPE, original photograph by *Cintract;* FIG. 2, plant from Pinopolis, South Carolina,

April, 1897, *Maria P. Ravenel;* FIG. 3, plant from Pinopolis, May, 1895, *E. Peyre Porcher.*

In PLATE 773, FIGS. 1 and 2 are from the TYPE-collection, × 1, of T. PUSILLUM, var. VIRGINIANUM, n. var.; FIG. 3, summit of T. LANCEOLATUM Boykin, × 1, from Aspalaga, Florida, April 11, 1902, *Biltmore Herb.*, no. 6085.

*NARCISSUS BIFLORUS Curtis. ISLE OF WIGHT COUNTY: rich calcareous wooded slopes by Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), *Fernald, Long & Abbe,* no. 14,130 Originally spread from cultivation.

CALOPOGON PALLIDUS Chapm. Range extended northward in ISLE OF WIGHT COUNTY: clearing in damp sandy pine barrens south of Zuni, no. 14,320. See p. 369.

*ULMUS PROCERA Salisb. CAROLINE COUNTY: steep wooded bluff by Rappahannock River, northwest of Return, *Fernald, Long & Abbe,* no. 14,136. See p. 358.

*ASARUM (§ HETEROTROPA) **Lewisii,** sp. nov. (TAB. 774 et 775), glabrescens; caule gracili subterraneo pallido valde elongato (ad 4 dm. longo), furcato ramibus stoloniferis; foliis longe-petiolatis solitariis coriaceis plus minusve maculatis deltoideis vel deltoideo-ovatis vel subreniformibus obtusis, sinu basalari rotundato, laminis maturis 2–8 cm. longis 2.5–8.5 cm. latis; flore pedunculato subnutante, calyce campanulato extus glabro griseo-brunneo, intus atropurpureo villoso, 2–3 cm. longo 1.3–2 cm. diametro, lobis vix patentibus.—Southeastern Brunswick County and southwestern Greensville County, VIRGINIA: bottomland-woods along Rattlesnake Creek, west of Triplett, Brunswick County, October 11, 1942, *Fernald & Lewis,* no. 14,480; sandy loam in woods along Whiteoak Creek, near Triplett, April 23, 1943, *Fernald & Lewis,* no. 14,531; mixed woods along Rattlesnake Creek, below Wright's Bridge, April 24, 1943, *Fernald & Lewis,* no. 14,532 (TYPE in Herb. Gray.); mixed woods along Rattlesnake Creek north of Ankum, Brunswick County, May 24, 1943, *Lewis,* no. 3825; bottomland-woods along Fontaine Creek west of Barley, Greensville County, May 17, 1943, *Lewis;* along Pea Hill Creek about a mile north of Gasburg, Brunswick County, May 29, 1943, *Lewis,* no. 3826. See pp. 374, 381–383.

In some ways combining the characters of our two eastern American sections of the genus. It has the deltoid to ovate or reniform, evergreen and often mottled leaves much as in *A. arifolium* Michx. or in *A. Ruthii* Ashe; while the extensively creeping and stoloniferous stems fork as freely as in *A. canadense* L., but they are subterranean, not superficial, much more slender, and bearing the scattered leaves singly along the axes and at the tips of the widely creeping stolons. Mr. Lewis had found only sterile plants, always in colonies on bottomlands or just above

the bottomland-levels of small creeks of southeastern Brunswick County, Virginia, which empty into Fontaine Creek and, eventually, into Meherrin River. In October, 1942, I had the great pleasure of visiting the Seward Forest, as the guest of the Director, Professor Alfred Akerman and Mr. Lewis, and when they showed me the strange *Asarum* it was, as Mr. Lewis had written, characteristic of the thin bottomland-woods just above creek-margins and where, during high water, it is regularly overflowed. It is colonial, making extensive colonies, with the rather small deltoid to ovate long-petioled leaves scattered (one-at-a-time), never in tufts.

In late April of 1943 I again was a guest at the Seward Forest, for Mr. Lewis had written that he had discovered a few flower-buds on different colonies, the very young buds showing some weeks after *A. canadense* and *A. virginicum* had begun blooming. On April 23, Dr. Akerman, Mr. Lewis and I found a few fully expanded flowers and several very young buds, usually only one fertile plant amongst hundreds of sterile ones, along Whiteoak Creek, near Triplett, and next day about the same meagre proportion of buds and fully grown flowers at the bases of gentle slopes to Rattlesnake Creek, these chiefly among fallen beech-leaves. And on April 26, when I had to be driven to Emporia to take the train back to Boston, we conceived the idea, since both Whiteoak and Rattlesnake Creeks empty into Fontaine Creek, one of the choice habitats of Greensville County to the east, of trailing the new species down that valley into the Coastal Plain. The first crossing to the eastward in Greensville County reassured us, for along Fontaine Creek, not far from its receipt of Rattlesnake Creek, near Barley, Mr. Lewis promptly detected a colony. That was the last we saw. Later, however, Lewis trailed it to Pea Hill Creek, which empties into the Roanoke River, his station being 10 miles farther west than those near Triplett. We are, then, forced to consider the new species as a highly localized one of southern Brunswick County and southwestern Greensville County.

Although as extensively creeping as *Asarum canadense*, its resemblance stops there. In foliage *A. Lewisii* is, as stated, related to *A. arifolium* and to *A. Ruthii* of *Asarum*, § *Heteroptropa* (the genus *Hexastylis* Raf., Small and their followers),

while its large drab-brown to drab-purple, campanulate calyx is nearly as large as in *A. Shuttleworthii* J. Britten (southwestern Virginia, Tennessee and Alabama), but with the outline of that of *A. virginicum*. In all these characteristic species of *Asarum*, § *Heterotropa*, the rhizome is stout and short, covered heavily with thick and very elongate roots and at summit forking into ascending crowns bearing tufted leaves. The new *Asarum Lewisii*, with which it is a great pleasure to associate the name of its discoverer, the perennially enthusiastic naturalist of the Seward Forest, John Barzillai Lewis, is unique in the section in its prolonged, slender, horizontal, subterranean, cord-like whitish rhizomes with few slender roots, the axes and the stolons bearing only scattered leaves. With this very effective vegetative reproduction and inhabiting bottoms where the plants are frequently submerged, *A. Lewisii* seems to flower (and then very sparingly) only when the colonies, as in late April and May of 1943, remain unsubmerged during the normal flowering period.

No fruit seems to form and the fragile peduncle readily breaks, even when the flowers are only partly grown.

Paronychia riparia Chapm. Limit of range extended northeastward in Southampton County: dry sand of open alluvial flat by Blackwater River, southeast of Unity, no. 14,324. See p. 370.

P. canadensis (L.) Wood. Local range extended eastward into Isle of Wight County: rich wooded slope above bottomland woods along Blackwater River, above Broadwater Bridge, north of Zuni, no. 14,325.

Holosteum umbellatum L. Apparently spreading; new or sandy roadside-fills in Essex and Hanover Counties. Perhaps introduced in foreign seed used on new soft shoulders. See p. 359.

Stellaria media (L.) Cyrill., var. glaberrima G. Beck. See Rhodora, xlii. 451 (1904). Add a station in Isle of Wight County: turfy waste ground back of sand-beach of Burwell's Bay, James River, below Rushmere (Fergusson's Wharf), *Fernald, Long & Abbe*, no. 14,142. See p. 360.

Cerastium brachypetalum Desportes. Local range extended north to Stafford County: roadside-fill about 4 miles southeast of Falmouth, *Fernald, Long & Abbe*, no. 14,144. See p. 358.

*Nymphaea odorata Ait., forma rubra Guillon. Sussex County: in water at margin of Chappell's Millpond (Honey Pond), west of Lumberton, no. 14,327, growing with the common white-flowered form.

Cabomba caroliniana Gray. Nansemond County: ditch

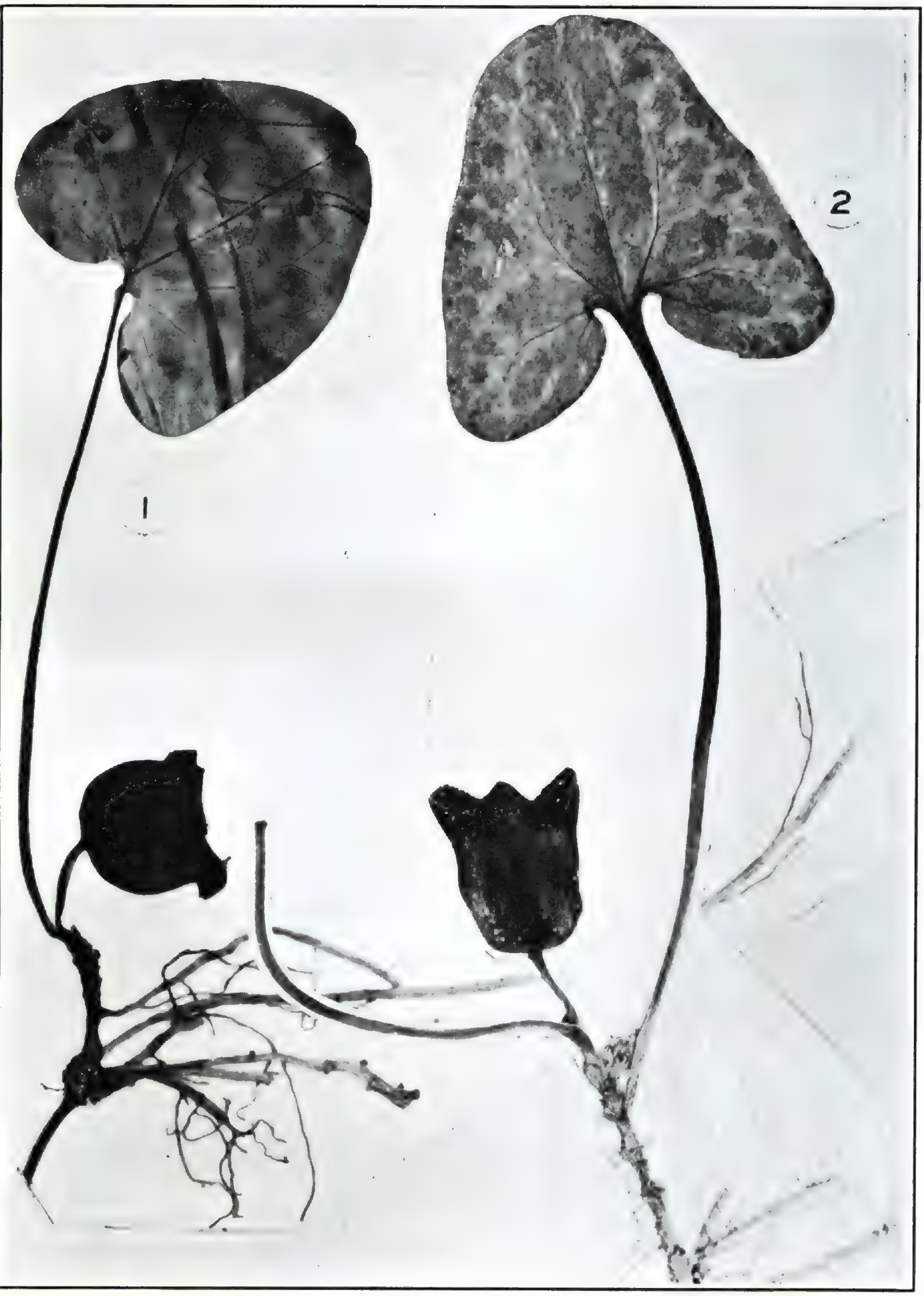


Photo. B. G. Schubert.

ASARUM LEWISII: FIGS. 1 and 2, portions of two flowering plants of TYPE-series, × 1

Photo. B. G. Schubert.

CLEMATIS OCHROLEUCA: FIG. 1, plant, × $^2/_5$, from Staten Island, N. Y., identified by comparison by Asa Gray with type of *C. ovata* Pursh; FIG. 2, lower leaf-surface, × 10; FIG. 3 flower, × 1; FIG. 4, fruiting head, × 1; FIG. 5, achene and base of tail, × 5

along highway, northern border of Great Dismal Swamp, east of Magnolia, no. 14,328. Our first station in the Tidewater counties. See p. 368.

RANUNCULUS ABORTIVUS L., var. INDIVISUS Fernald. STAFFORD COUNTY: disturbed soil at border of rich woods about 3 miles southeast of Falmouth, *Fernald, Long & Abbe*, no. 14,148. First except along Nottoway River. See p. 358.

R. SARDOUS Crantz. Local range extended into SUSSEX COUNTY: siliceous and argillaceous fallow field, Jarratt, *Fernald, Long & Abbe*, no. 14,151. In view of the dominance of this species in fields and pastures about Franklin, likely to spread rapidly.

MORPHOLOGICAL DIFFERENTIATION OF CLEMATIS OCHROLEUCA AND ALLIES (PLATES 776–782)—The simple-leaved and erect species of *Clematis*, of which *C. ochroleuca* Ait. Hort. Kew. ii. 260 (1789) was the first American one described, has had many treatments. So far as I can find there is no clear demonstration of the identity of the plant described by Aiton. It was cultivated in England and very briefly described, the name given on account of the color of the sepals. It is and has been assumed to be the most eastern of species, found chiefly in the Piedmont and inner Coastal Plain region from southeastern New York to southeastern North Carolina and the mountains of northern Georgia. Until Aiton's material is checked, with the real morphological distinctions in the group clearly in mind, the established interpretation should not be disturbed. It is evident, certainly, that the Plukenet plant from Banister cited by Aiton "flore unico ochroleuca" is the plant generally known as *C. ochroleuca*. Plukenet's figure is characteristic.

My object in this note is to define on more stable and fundamental lines than are relied upon in the two latest treatments, the eastern species of *Clematis*, § *Viorna*, sub-§ *Integrifoliae*. The latest treatment, that of Erickson in Ann. Mo. Bot. Gard. xxx. 13 and 35–39 (1943), keys our species in a manner quite reminiscent of the key of Wherry in Journ. Wash. Acad. Sci. xxi. 195 (1931). Wherry's key was as follows:

"Plant sparingly branched and small leaves relatively few; head of fruit tending to be spherical, about 6 cm. in diameter; achenes nearly symmetrical.
Under side of leaves glabrate to moderately pubescent; hairs of achene-appendages deep, or exceptionally pale, yellow; range chiefly at altitudes below 1000 feet, mostly in Piedmont..... **C. ochroleuca ovata**

Under side of leaves moderately to densely pubescent; hairs of achene-appendages pale, or exceptionally deep, yellow; range chiefly at altitudes above 1000 feet, mostly in Blue Ridge ..... **C. ochroleuca sericea**

Plant copiously branched and small leaves relatively numerous; leaves glabrate.

Head of fruit nearly spherical, about 5 cm. in diameter; achenes fairly symmetrical, their appendage-hairs brown ..... **C. viticaulis**

Head of fruit spheroidal, about 4 cm. high and 6 cm. broad; achenes rather unsymmetrical, their appendage-hairs whitish ..... **C. albicoma**"

As above stated, the latest monographer of the section gives in his key no more fundamental distinctions than these and leans primarily on the evasive and contradictory degree of branching (note the contradiction in his "EE" and its subordinate "FF", below) and the still more evasive degree of coloring (note "EE" with "achene-tails usually lighter in color" as contrasted with "E" in which the color is "reddish-brown", the first species under the "lighter . . color" being *C. ochroleuca* in which the tails (styles) may be "tawny". Here is Erickson's statement of the "specific" differences:

"E. Plant profusely branched; leaves lanceolate, less than 6 cm. long; sepals glabrous; achene-tails reddish-brown ..... 13. *C. viticaulis.*

EE. Plant less branched; leaves ovate, at least some of them more than 6 cm. long; sepals pubescent; achene-tails usually lighter in color.

F. Plants simple or few-branched, more or less pubescent; achene-tails light yellowish-brown to tawny ..... 11. *C. ochroleuca.*

FF. Plants usually much branched, often white silky-pubescent throughout; achene-tails whitish or pale yellow ..... 12. *C. albicoma.*"

Not having the field-familiarity of Dr. Wherry with *C. albicoma* and *C. viticaulis*, I have been forced to my interpretation of these two treatments thus handicapped. By following the above keys I arrive at very perplexing results, for the characters depended upon are such as vary with extreme plasticity; and, whereas Erickson says in his key that the leaves of *C. viticaulis* are "lanceolate" as opposed to "ovate" in *C. ochroleuca* and *C. albicoma*, his fuller account of *C. viticaulis* says "leaves lanceolate to narrowly ovate", the other two species being assigned leaves which may also be "narrowly ovate".

As to the degree of branching so much relied upon in the two treatments, I, again, have been handicapped by not having

before me all the material their authors studied, except that in the Gray Herbarium, which was borrowed by Erickson. I have, however, had the great advantage of studying a large series of specimens from the Blue Ridge in Roanoke County, Virginia, most kindly sent me for study by Mr. Carrol E. Wood, Jr. Taking into consideration only the plants which are complete down to the lowest node (omitting obviously broken-off branches) I get the following results.

NUMBER OF BRANCHES FROM MAIN AXIS

C. OCHROLEUCA, "plant sparingly branched" or "simple or few-branched" (47 plants): branches 0=13 specimens; 1=1; 2=5; 3=4; 4=7; 5=6; 6=7; 7=3; 9=1. Average 3.2 branches.

C. VITICAULIS, "plant copiously" or "profusely branched" (7 plants): branches 0=1; 2=1; 4=2; 5=1; 6=1; 8=1. Average 3.4 branches.

C. ALBICOMA, typical glabrescent plant, "copiously" or "usually much branched" (19 specimens): branches 0=4; 3=1; 4=2; 5=5; 6=3; 7=1; 8=3. Average 4.5 branches.

C. ALBICOMA, tomentose var., "plant copiously" or "usually much branched" (36 plants): branches 0=4; 1=4; 2=5; 3=8; 4=6; 5=4; 6=3; 7=1; 8=1. Average 3.2 branches.

With more than half of the complete plants of the "simple or few-branched" *C. ochroleuca* (PLATE 776, FIG. 1) having 4–9 elongate axillary branches, while the "profusely" or "usually much branched" species show nearly half the plants with less than 4 branches, I am quite incapable of applying the character as a clear diagnostic one or even a worth-while tendency.

As to leaf-outline and size one also has to be pretty cautious. The sheet of *Adams & Wherry*, no. 2413, from the type-locality of *Clematis viticaulis*, defined in Erickson's key as having "leaves lanceolate, less than 6 cm. long", shows blades 6.5 cm. long by 3 cm. broad. As already noted, such leaves are narrowly ovate, rather then "lanceolate". Other topotypic specimens of *C. viticaulis* show primary leaves with the following dimensions: *Killip*, no. 32,484 (PLATE 778, FIG. 1), blades 7 cm. long; *Adams & Wherry*, no. 2418, blades 7.8 cm. long by 4 cm. broad; *Wherry*, June 11, 1930, blades 7 cm. long by 4.6 cm. broad, much more than "narrowly ovate". As a key-character "leaves lanceolate, less than 6 cm. long" is not wholly satisfactory, especially since, likewise, so many specimens of *C. albicoma* in the most restricted sense have leaves scarcely different in shape and size, topotypes (from Kate's Mountain) showing the largest leaves 6.2 cm. long

(*Gilbert*, no. 511), 6–6.5 cm. (*Marion S. Franklin*, September 4, 1920, our PLATE 779, FIG. 1), 6.2 cm. (*Small*, May 16, 1892), 7 cm. (*Hermann & Martin* in Pl. Exsicc. Gray., no. 951), 7 cm. (*Core*, no. 2708), 5.8 cm. (*Addison Brown*, July 22, 1892), while plants from near Deerfield, Augusta County, Virginia (*Wherry*, no. 2420), have the larger leaves only 4.5 cm. long. Here, again, those who hope for clarification find "a distinction without a difference".

In his key Erickson assigns *Clematis viticaulis* "sepals glabrous" as opposed to the pubescent sepals in the other plants. I hope they are glabrous; Steele, in describing the species, did not know them, and Wherry cited besides Steele's collection only his own from the type-locality, collected June 11, 1930. As shown by the two flowers of Wherry's plant in the Gray Herbarium, the sepals (PLATE 778, FIG. 2) are closely pilose. In fact, in his detailed description (p. 38) the "sepals glabrous" of Erickson's key were allowed to be "slightly pubescent without". Those of Wherry's topotype, however, are certainly less pubescent than in *C. albicoma* (PLATE 779, FIG. 4) or in *C. ochroleuca* (PLATE 776, FIG. 3).

As to the fruiting head, in Wherry's treatment that of *C. ochroleuca* is "tending to be spherical, about 6 cm. in diameter," that of *C. viticaulis* "nearly spherical, about 5 cm. in diameter" and that of *C. albicoma* "spheroidal, about 4 cm. high and 6 cm. broad". The abundant series of *C. ochroleuca* before me shows that the mature fruiting heads (PLATE 776, FIG. 4) range from 5–10 (average 7) cm. in diameter, with the long plumose styles loosely separated at the margin of the head, while in *C. albicoma* the mature head (PLATE 779, FIG. 1 and 780, FIG. 6) is compact, with tightly recurving plumose styles, the heads 4–7 cm. thick. The fruiting head of *C. viticaulis* (PLATE 778, FIGS. 1 and 3) is as small as in *C. albicoma* but with fewer and loosely spreading plumes (much as in *C. ochroleuca*). I am not sufficiently a mathematician fully to appreciate the differences between "tending to be spherical", "nearly spherical" and "spheroidal". According to the Century Dictionary a spheroid is "A geometrical body approaching to a sphere, but not perfectly spherical". Since in *C. ochroleuca* the fruiting head is "tending to be spherical" and in *C. viticaulis* only "nearly spherical" while in *C.*

albicoma it is "spheroidal" (i. e. "approaching to a sphere, but not perfectly spherical") this character is too erudite for me.

Similarly, the exact shades of difference between "nearly symmetrical", "fairly symmetrical" and "rather unsymmetrical" are difficult to visualize. Furthermore, the distinctions between "deep, or exceptionally pale, yellow", "pale, or exceptionally deep, yellow" are not wholly satisfactory. In characteristic *Clematis ochroleuca*, the easternmost plant, the mature plumes range from a deep, almost cinnamon-brown to whitish-yellow or pale buff, the range in color being comparable to that in the mature perianths of *Eriophorum virginicum;* and, although the plumes of *C. albicoma* are commonly whitish-gray or drab (on white paper they do not look "whitish"), the series of its more pubescent and relatively eastern variety sent me for study by Mr. Wood shows some numbers with plumes as brown as in average *C. ochroleuca.* Exactly the same range of color occurs in other species of § *Viorna.* In *C. Viorna* L. Erickson rightly allows the "achene-tails . . . light yellow or brownish". In some recently collected (therefore not faded) material before me (*Godfrey*, no. 5004 from Wake County, North Carolina) they are as pale as in extreme *C. albicoma*, while in other material (*Godfrey & Tryon*, no. 806 from Orangeburg County, South Carolina) they are as dark as in the most extreme *C. ochroleuca* or as in *C. viticaulis.* Color of hair, like the other characters used in recent keys, is not sufficiently stable to demonstrate that *C. ochroleuca, C. viticaulis* and *C. albicoma* are clear-cut species.

There are, however, some characters of deeper significance, which seem to show that *Clematis albicoma* and *C. viticaulis* are really separable. In fact, Erickson recorded the most significant characters in his descriptions of the three but these points, which are the strongest ones, were omitted from his key in favor of superficial and wholly inconstant ones. I refer to the great elongation of the fruiting peduncles in *C. ochroleuca* (PLATES 776 and 777), as opposed to the relatively short peduncles of the others, and to the very different direction of the pubescence on carpels and achenes. These characters are constant in all the material I have seen, without regard to degree of pubescence of stem and leaf, size of leaf, amount of branching and paleness or deepness of color of the coma. To me they are the soundest

differential characters, though not so easy to see without careful examination.

The white-silky or -tomentose plant (PLATE 780) concentrated on the Blue Ridge, of which Mr. Wood sends me a splendid series for study (largely as a loan) is evidently what Wherry had primarily in mind when he published the combination *C. ochroleuca*, var. *sericea* (Michx.) Wherry. Since it is not *C. sericea* Michx. (PLATE 777) and since its more stable characters are those of *C. albicoma*, to which Wherry often referred specimens and with which essentially glabrous and mostly more western plant (PLATE 779) Erickson merges this white-pubescent one of the Blue Ridge, I am redefining the latter. As I understand the three species and the variety, I treat them as follows:

a. Carpels and achenes with appressed pubescence, that at the summit pointing forward; lowest villi of the fruiting style ascending or spreading-ascending; fruiting head with styles loosely separated at margin.

Stems either simple or loosely branched, the branches only exceptionally overtopping the main axis; larger leaves of primary stem 6–12 cm. long, silky-pilose to glabrate beneath; flowers 2–3.5 cm. long, the cinereous backs of the sepals densely silky-villous; mature fruiting peduncle lengthening to 5–19 (av. 11+) cm., much overtopping the subtending leaves; mature fruiting head 5–10 (av. 7) cm. in diameter, the plumose styles 3–6 cm. long ..... *C. ochroleuca.*

Stems with axillary branches often overtopping the main axis; larger leaves of primary axis 5–7.8 cm. long, glabrescent beneath; flowers about 2 cm. long, the greenish backs of the sepals only minutely pilose; mature fruiting peduncles 1–5 cm. long, shorter than subtending leaves; mature fruiting head 4–5.5 cm. in diameter, the brownish plumose styles 2–3 cm. long .... *C. viticaulis.*

a. Carpels and achenes with horizontally divergent to reflexed long hairs on the upper half; lowest villi of the fruiting style similarly divergent; fruiting head with styles strongly arcuate-recurved, 3–5 cm. long, the head consequently compact; fruiting peduncles 3–9 cm. long; flowers 1.7–2.8 cm. long; central axis often or usually overtopped by axillary branches.

Main axis 2–3 dm. high, the stems loosely pilose but becoming glabrescent; leaves at first sparingly pilose on veins beneath, otherwise glabrous, soon quite glabrate, the larger ones 4–7.5 cm. long and 1.5–4.5 cm. broad ..... *C. albicoma.*

Main axis 2–4.5 dm. high, the stems densely and persistently pilose-tomentose; leaves persistently pilose-tomentose beneath, the larger ones 6–10 cm. long and 4–9 cm. broad ..... *C. albicoma*, var. *coactilis.*

Since the descriptions, ranges and citation of specimens of

Photo. B. G. Schubert.

TYPE of CLEMATIS SERICEA Michx. = C. OCHROLEUCA Ait.: FIG. 1, two plants, × ½; from photograph by *Cintract;* fig. 2 stem, × 2½; FIG. 3, peduncle, × 2½; FIG. 4, tails of fruit, × 2½

Photo. B. G. Schubert.

CLEMATIS VITICAULIS: FIG. 1, topotype, × ½; FIG. 2, back and margin of sepal, × 10; FIG. 3, fruiting head, × 1; FIG. 4, achene and base of tail, × 5

C. INTEGRIFOLIA: FIG. 5, surface of stem × 10; FIG. 6, lower leaf-surface, × 10; fig. 7, flower, × 1; FIG. 8, fruiting head, × 1

C. ochroleuca (our PLATE 776) and *C. viticaulis* (PLATE 778, FIGS. 1–4) have been so well given by Erickson, it is here necessary only to define the restricted *C. albicoma* and its var. *coactilis*.

*CLEMATIS ALBICOMA Wherry, var. **coactilis,** var. nov. (TAB. 780), planta habitu *C. albicomae* typicae simillima plerumque ramosa ramis lateralibus axem centralem superantibus; caule centrali 2–4.5 dm. alto densissime persistenterque villoso-tomentoso; foliis dilatatis axis primarii 2–3-jugis ovatis majoribus deinde 7.5–10 cm. longis 5.5–9 cm. latis coriaceis subtus persistenter piloso-tomentosis; foliis ramorum elongatorum 2–4-jugis majoribus 6–10 cm. longis 4–6 cm. latis; pedunculis crassis dense villoso-tomentosis deinde 4–9 (av. 6.6) cm. longis; sepalis anguste ovatis 2.8 cm. longis 1.3 cm. latis dorso densissime villoso-tomentosis; capitulo fructifero denso 4–6 (av. 4.8) cm. diametro; achaeniis oblique subrhomboideo-obovatis plus minusve strigosis dorso apiceque divergenter villosis; stylo maturo valde arcuato-recurvato 3–5 cm. longo, albido- vel sordido-plumoso, villis inferioribus horizontaliter divergentibus superioribus plus minusve adscendentibus.—Mountains of western VIRGINIA: Roanoke County: shaly southwest-facing slope of Green Ridge, about 2.25 miles northeast of Hanging Rock, April, 1940, *Carroll E. Wood, Jr.*, no. 127 (flowering); dry ledges along Mason Creek, about 1.25 miles north of Hanging Rock, June 24, 1942, *Wood*, no. 2787a; shaly soil, open oak woods about 1.8 miles north-by-east of Hanging Rock, June 30, 1942, *Wood*, no. 3427; shaly slope about 2 miles north-northeast of Hanging Rock, June 30, 1942, *Wood*, nos. 3432 and 3433 (TYPE in Herb. Gray.); shaly slope about 2.25 miles northeast of Hanging Rock, June 30, 1942, *Wood*, nos. 3445 and 3446; exposed shale barrens (alt. 2800 ft.), Fort Lewis Mountain, about 2.9 miles north-northwest of Dixie Caverns, July 13, 1942, *Wood*, nos. 3920 and 3936. Montgomery County: shale barren 1 mile northeast of Ironto, June 12, 1939, *Wherry* (distrib. as *C. albicoma* Wherry or *C. ochroleuca*, var. *sericea* (Michx.) Wherry). Craig County: shale barren along Craig Creek, 0.5 mile southeast of Newcastle, August 13, 1937, *Fogg*, no. 13,255; barren along Broad Run, 3.5 miles south of Newcastle, June 12, 1939, *Wherry* (distrib. as *C. albicoma*).

The very full series assembled by Mr. Wood and identified by Dr. Wherry as *Clematis ochroleuca* Ait., var. *sericea* (Michx.) Wherry in Journ. Wash. Acad. xxi. 197 (1931) demonstrates to me very effectively the distinctness of *C. albicoma*, var. *coactilis* from *C. ochroleuca* Ait. and from typical *C. albicoma* Wherry (PLATE 779). *C. ochroleuca* (PLATES 776 and 777), occurring from southeastern New York to Georgia, is a relatively taller

plant (2–6 dm. tall), either simple or loosely branched, the branches only exceptionally overtopping the main axis, the internodes more elongate; the young foliage silky-pilose beneath, the silkiness (PLATE 776, FIG. 2) either persistent or disappearing; the young stems pilose, the mature ones sparsely so to glabrate; the fruiting peduncles slender and elongate, 5–19 (av. 11+) cm. long and sparsely pilose to glabrate (PLATE 777, FIG. 2); the fruiting head (PLATE 776, FIG. 4) 5–10 (av. 7) cm. in diameter, with the long plumose styles loosely separated at the margin of the head, either yellowish-brown or drab; the achene (FIG. 5) strigose-sericeous to summit, the gradually arching style 4–6.5 cm. long, with basal villi (FIG. 5) loosely ascending or spreading-ascending.

C. albicoma (PLATE 779) was not formally described by its author, who said that it was "*C. ovata* of current manuals, not Pursh", leaving the reader to figure out the characters except as stated in his key: *C. ochroleuca* (var. *ovata* (Pursh) Wherry) and *C. ochroleuca*, var. *sericea* (Michx.) Wherry defined: "Plant sparingly branched and small leaves relatively few; head of fruit tending to be spherical, about 6 cm. in diameter; achenes nearly symmetrical". Opposed to this is the call embracing *C. viticaulis* Steele and the new *C. albicoma:* "Plant copiously branched and small leaves relatively numerous; leaves glabrate", under which *C. albicoma* is defined "Head of fruit spheroidal, about 4 cm. high and 6 cm. broad; achenes rather unsymmetrical, their appendage-hairs whitish". Since typical *C. ochroleuca* may have 3 or 4 pairs of elongate branches (Staten Island material from *T. F. Allen*—PLATE 776, FIG. 1—or from *E. G.* or *N. L. Britton*, Brooklyn specimens of *John Carey*, Washington material of *L. F. Ward*, and various specimens from eastern Virginia and North Carolina), the first differentiation, as already emphasized, is not clear; and as also noted, furthermore, the difference between heads "tending to be spherical" and heads "spheroidal" is not vivid. We are left with the achene of *C. ochroleuca* "nearly symmetrical", that of *C. albicoma* "rather unsymmetrical". *C. albicoma* is typified as the plant of Kate's Mountain, Greenbrier County, West Virginia. Taking that as a starting point and the descriptions of "*C. ovata* of current manuals" the concept is somewhat clarified. It (PLATE 779) is a usually low-

branching plant with the main axis 2–3 dm. high, the lateral branches soon strongly overtopping it; stem loosely pilose (FIG. 2), becoming glabrescent; leaves at first sparingly pilose on veins beneath, otherwise glabrous, soon quite glabrate (FIG. 3); well-developed leaves of primary axis 1–3 pairs, the larger ones 5.5–7.5 (av. 6.25) cm. long and 2.5–4.4 (av. 3.6) cm. broad; elongate ascending branches with 3 or 4 pairs of well developed leaves, the larger blades 4–7 (av. 6) cm. long and 1.5–4 (av. 3) cm. broad; fruiting peduncles sparsely short-pilose or glabrate, in fruit 3–8 cm. long; sepals (FIG. 4) lanceolate, 1.7–2.7 cm. long and 4–8 mm. broad; fruiting head (FIG. 1) depressed-globose, 4–7 cm. broad; achenes (FIG. 5) divergently long-villous on back and at summit; the fruiting style about 4 cm. long, horizontally villous at base, the whitish-gray villi more ascending toward the apex.

C. albicoma, typified by the plant of Kate's Mountain, and the newly proposed var. *coactilis* (PLATE 780) are nearer to each other than either of them is to the more eastern *C. ochroleuca* (PLATES 776 and 777). I agree with Dr. Wherry that *C. ovata* Pursh, based upon a Catesby specimen from Virginia in the Sherard Herbarium at Oxford, is *C. ochroleuca*. A tracing of it made by me in 1903 shows the characteristics of the latter and it may be noted on PLATE 776 that in 1881 Asa Gray reached the same conclusion. Judging from his very brief characterization *C. ochroleuca*, var. *sericea* sensu Wherry, l. c. 195 and 197 (1931), partly included *C. albicoma*, var. *coactilis*. He did not note the rather striking difference in the pubescence of the carpels and fruits of *C. ochroleuca* and of *C. viticaulis*, as contrasted with those of *C. albicoma*, here discussed and illustrated, nor the marked difference in length of peduncle, size of fruiting head and compactness or looseness of the latter.

Clematis albicoma, var. *coactilis* is not *C. sericea* Michx. Fl. Bor.-Am. i. 319 (1803); and the combination *C. ochroleuca sericea* (Michx.) Wherry, l. c. 197, resting upon Michaux's name, nomenclaturally is the same as *C. sericea*. The TYPE of *C. sericea* (at least the material preserved in Michaux's herbarium) consists of two branches (PLATE 777) in young fruit. They both have the relatively sparse pubescence (FIGS. 2 and 3) and the very elongate and slender peduncles (11 cm. long) of *C. ochro-*

leuca, also the characteristic appressed-ascending villosity (FIG. 4) of the fruiting style-base. In interpreting Michaux's original account it must be borne in mind that he thought that his *C. sericea* was perhaps Aiton's *C. ochroleuca*, that he was comparing it with the Eurasian *C. integrifolia* L. (PLATE 778, FIGS. 5–8) which has nearly glabrous or only minutely hirtellous stem (FIG. 5), glabrous or promptly glabrate leaves (FIG. 6), elongate-lanceolate sepals up to 5 cm. long (FIG. 7) and nearly or quite glabrous on the back, and loose fruiting head (FIG. 8) much like that of *C. ochroleuca*. With *C. integrifolia* before him Michaux described his American material as

> SERICEA. C. caule erecto, pubentissimo: foliis simplicibus, ovalibus; junioribus calycibusque extus incano-sericeis: pedunculo terminali, solitario; flore cernuo.
> *C. ochroleuca*? Ait.
> *OBS.* Affinis *C. integrifoliae;* flore conspicue minore; calyce angustiore. Folia sessilia, opposita, pubescentia.
> *HAB.* in Virginia et in montanis Carolinae.

As contrasted with that of *Clematis integrifolia* the stem of *C. ochroleuca* is "pubentissimo", and the lower surfaces of the young leaves (PLATE 776, FIG. 2) and the outside of the calyx (FIG. 3) are sericeous. The calyx of *C. ochroleuca* is much shorter than in *C. integrifolia*, though the sepals are of about the same shape. In the montane *C. albicoma*, var. *coactilis* (PLATE 780, FIG. 5) the sepals are much broader. The Michaux diagnosis and comparative note give a good characterization of the common *C. ochroleuca* of the Piedmont and inner Coastal Plain region from southeastern New York southward, a species Michaux would have had great difficulty in avoiding.

In 1875 Sereno Watson received from his relative, Dr. Louis Watson of Ellis, Kansas, a variable series of the most western representative of § *Viorna*, sub-§ *Integrifoliae* from Ellis. Some of the specimens, with heavily coriaceous subrotund to ovate or oblong, obtuse leaves, Watson associated with a poor old specimen without stated locality collected on Fremont's 2nd Expedition; and from this series of 12 plants he described *Clematis Fremontii* Watson in Proc. Am. Acad. x. 339 (1875). The series shows simple or branching plants, varying from 1.4 to 4.5 and more dm. (judging from broken-off specimens up to 5.5 dm.) high. Some have heavy oblong leaves at most 5 cm. long

Photo. B. G. Schubert.

CLEMATIS ALBICOMA: FIG. 1, portion of topotype, × 1; FIG. 2, surface of stem, × 10; FIG. 3, lower leaf-surface, × 10; FIG. 4, flower, × 1; FIG. 5, achene and base of tail, × 5

Photo. B. G. Schubert.

CLEMATIS ALBICOMA, VAR. COACTILIS: FIG. 1, TYPE, × 3/7; FIG. 2, peduncle, × 10; FIG. 3, lower leaf-surface, × 10; FIG. 4, summit of sepal, × 10; FIG. 5, flower, × 1; FIG. 6, fruiting head, × 1; FIG. 7, achene and base of tail, × 10

and 2 cm. broad (PLATE 781, FIG. 3), others narrowly ovate ones (FIG. 2), while the broadest-leaved specimens show rounded-ovate and very heavy blades 1.4 × 1.15 dm. (FIG. 1). These form a consistent but highly variable series and are typical *C. Fremontii*. They all have coriaceous foliage strongly overlapping, short internodes and stout fruiting peduncles 0.5–4 cm. long.

One of the Ellis specimens (PLATE 782, FIG. 1), however, not marked by Watson as his *C. Fremontii*, as were all the others, but later so labeled by Asa Gray, differs in its elongate internodes, relatively thin and elliptic-oblong to lance-ovate leaves and slender peduncle, in anthesis more than 5 cm. long. This specimen is intermediate between the most divergent material of var. *Riehlii* Erickson, l. c. 40 (1943), a plant set off on just these characters and said by its author to have "complete geographical isolation". PLATE 782, FIG. 1 shows the summit of the narrow-leaved plant from Ellis, Kansas (the specimen identified by Erickson as TYPICAL *C. Fremontii*). FIG. 2 is a tip from Allenton[1], Missouri (coll. June 10, 1887, by G. W. Letterman) of var. Riehlii. FIG. 3 is a leaf and fruiting peduncle from another Letterman Collection, called by Erickson var. *Riehlii* because from eastern Missouri. In view of the figures given by Erickson of leaf-outlines from "Mass collections" of *C. Fremontii* made in Ellis County, it is a pity that he did not get hold of the plant shown in our PLATE 782, FIG. 1 or such plants as shown in PLATE 781, FIGS. 2 and 3, also from Ellis. They would have materially changed the outlines. Var. *Riehlii* is, it should be evident, not always "completely isolated" from typical *C. Fremontii*. Dr. Louis Watson got it along with the other variations in Ellis County, Kansas. Whether it is more than an ecological variant of more sheltered or less arid habitats is doubtful. Otherwise it would not in Franklin County, Missouri, have such rounded-ovate leaves as that shown in PLATE 782, FIG. 3 (identified and cited as var. *Riehlii*) and in Ellis County, Kansas, sometimes so closely imitate the eastern plant with elongate leaves.

[1] To those who know, what any good atlas will reveal, that St. Louis, Allenton and Eureka are all in St. Louis County, Missouri, it will come as a shock to read in the citations accompanying the original description of var. *Riehlii*: "COUNTY NOT DETERMINED OR DOUBTFUL: . . . St. Louis . . . ; Allenton . . . ; Eureka." In a succeeding article, but not in the one where the statement was published, Erickson, l. c. 64, it is revealed that the doubt was as to whether the cited specimens actually were collected in St. Louis, Allenton and Eureka, not as to the county in which these towns are located!

PLATE 776 is of CLEMATIS OCHROLEUCA Ait.: FIG. 1, characteristic branching plant, × ⅖, from Staten Island, New York, May 23, 1884, *T. F. Allen*, with memorandum made by Asa Gray of its identity with *C. ovata* Pursh; FIG. 2, lower surface of leaf, × 10, from Staten Island, 1879, *N. L. Britton;* FIG. 3, flower, × 1, from New Dorp, Staten Island, May, 1887, *Torr. Bot. Club;* FIG. 4, fruiting head, × 1, from Four Mile Run, Virginia, *Pollard*, no. 334; FIG. 5, achene and base of tail, × 5, from east of McKenney, Virginia, *Fernald & Long*, no. 14,329.

PLATE 777, TYPE of C. SERICEA Michx. = C. OCHROLEUCA Ait.: FIG. 1, two plants, × ½; FIG. 2, stem of plant at left, × 2½; FIG. 3, peduncle, × 2½; FIG. 4, tails of fruit, × 2½, from plant at right.

PLATE 778, FIGS. 1–4, C. VITICAULIS Steele: FIG. 1, topotype, × ½, from *Killip*, no. 32,484; FIG. 2, back and margin of sepal, × 10, from topotype, *Wherry*, June 11, 1930; FIG. 3, fruiting head, × 1, from last specimen; FIG. 4, achene and base of tail, × 5, from topotype, *Adams & Wherry*, no. 2418. FIGS. 5–8, C. INTEGRIFOLIA L.: FIG. 5, stem, × 10, from Alkabek River, Altai, southern Siberia, *F. N. Meyer*, no. 766; FIG. 6, lower surface of leaf, × 10, from no. 766; FIG. 7, flower, × 1, from Hungary, *F. Schultz, Herb. Norm.* no. 2501; FIG. 8, fruiting head, × 1, from no. 2501.

PLATE 779, C. ALBICOMA Wherry: FIG. 1, portion of topotype, × 1, from *Marion S. Franklin*, September 4, 1920; FIG. 2, stem, × 10, from topotype, *F. A. Gilbert*, no. 511; FIG. 3, lower surface of leaf, × 10, from no. 511; FIG. 4, flower, × 1, from topotype, *Heller*, no. 842; FIG. 5, achene and base of tail, × 5, from no. 511.

PLATE 780, C. ALBICOMA, var. COACTILIS Fernald, all (unless noted) from TYPE: FIG. 1, plant, × 3/7; FIG. 2, peduncle, × 10; FIG. 3, lower surface of leaf, × 10; FIG. 4, summit of sepal, × 10; FIG. 5, flower, × 1, from *C. E. Wood, Jr.*, no. 127; FIG. 6, fruiting head, × 1, from *Wood*, no. 3427; FIG. 7, achene and base of tail, × 10.

PLATE 781, C. FREMONTII S. Wats., all from original series from Ellis, Kansas: FIGS. 1–3, leaves, × 1, from different individuals; FIG. 4, achene and base of tail, × 5.

PLATE 782, C. FREMONTII S. Wats.: FIG. 1, leaf and flower, × 1, from Ellis, Kansas, *Dr. Louis Watson*, 1875, labeled by Erickson as typical *C. Fremontii;* FIG. 2, leaf and denuded flower, × 1, of var. *Riehlii* Erickson, from Allenton, Missouri, June 10, 1887, *Letterman;* FIG. 3, leaf and fruit, × 1, labeled by Erickson as var. *Riehlii*, from Franklin County, Missouri, June, 1882, *Letterman.*

ASIMINA PARVIFLORA (Michx.) Dunal. Northern limit of range extended well into ISLE OF WIGHT COUNTY: sandy wooded slope by Blackwater River, west of Blackwater School, no. 14,331. See p. 370.

CORYDALIS FLAVULA (Raf.) DC. To the few recorded Coastal Plain stations add the following. STAFFORD COUNTY: rich woods along brook about 3 miles southeast of Falmouth, *Fernald, Long & Abbe*, no. 14,157. GREENSVILLE COUNTY: rich woods along Meherrin River, below Emporia, *Fernald & Lewis*, no. 14,536. See p. 358.

FUMARIA OFFICINALIS L. To the few recorded stations add one in ESSEX COUNTY: weed in old field near Ware's Wharf, northeast of Dunnsville, *Fernald, Long & Abbe*, no. 14,156.

DROSERA ROTUNDIFOLIA L. Local range extended to the west of the Blackwater River (former inland limit on Coastal Plain) in SOUTHAMPTON COUNTY: mossy thicket by Cephalanthus-pool

near Johnson's Millpond, north of Sedley, nos. 14,332 and 14,333. See p. 371.

D. CAPILLARIS Poir. To the several known stations add an exceptionally fine one in SUSSEX COUNTY: upper border of sandy beach of Airfield Millpond, southwest of Wakefield, no. 14,334. See p. 372.

(*To be continued*)

NOTES ON SOLIDAGO, SECTION EUTHAMIA.—In making a study of *Solidago*, section *Euthamia*, it becomes evident that a number of new combinations and changes of names are necessary:

S. GYMNOSPERMOIDES (Greene) Fernald, var. **callosa,** nom. nov. *Euthamia pulverulenta* Greene, Pittonia, v. 75 (1902). Non *S. pulverulenta* Nutt., Gen. ii. 161 (1818).

S. GRAMINIFOLIA (L.) Salisb., var. **tricostata** (Lunell), comb. nov. *Euthamia camporum*, var. *tricostata* Lunell, Am. Midl. Nat. ii. 59 (1911). *S. graminifolia*, var. *septentrionalis* Fernald, RHODORA, xvii. 12 (1915).

S. GRAMINIFOLIA (L.) Salisb., var. **media** (Greene), comb. nov. *Euthamia media* Greene, Pittonia, v. 74 (1902). *S. perglabra* Friesner, Butler Univ. Bot. Stud. iii. 61 (1933).

S. GRAMINIFOLIA (L.) Salisb., var. **remota** (Greene), comb. nov. *Euthamia remota* Greene, Pittonia v. 78 (1902). *S. Moseleyi* Fernald, RHODORA, x. 92 (1908).

S. GALETORUM (Greene) Friesner, Butler Univ. Bot. Stud. iii. 58 (1933). *Euthamia galetorum* Greene, Leaflets, ii. 152 (1911). *S. tenuifolia* Pursh, var. *pycnocephala* Fernald, RHODORA, xxiii. 293 (1922).

S. CAROLINIANA (L.) BSP., Prelim. Cat. N. Y. Pl. 26 (1888). *Erigeron carolinianum* L., Sp. Pl. 863 (1753). *S. minor* (Michx.) Fernald, RHODORA, x. 93 (1908).

—STUART K. HARRIS, Boston University

TRAGOPOGON DUBIUS IN INDIANA.—This species is not mentioned in Deam's "Flora of Indiana", all yellow-flowered specimens of the genus being referred to *T. pratensis*. However, I have examined a large number of plants in several localities within the city limits of Gary, Lake Co., where they are now abundant, and also in adjacent Porter Co., where they are less frequent but common. Every specimen I have studied has the involucral bracts well exceeding the flowers, and the peduncles

much thickened at the top, both characters of *T. dubius* Scop. I had myself considered these plants as *T. pratensis* until reading a recent article in Rhodora[1]. It might be well to reëxamine all Indiana plants deposited in herbaria and labelled *T. pratensis*, as some of them, at least, may be *T. dubius*. Several specimens among the plants on which this note was based, have been sent to the Gray Herbarium.—Edwin D. Hull, Gary, Indiana.

[This large-headed species, *Trapogan dubius* Scop. (1772), including *T. major* Jacq. (1773) has recently been sent to the Gray Herbarium from Virginia, Michigan, Illinois, Minnesota, South Dakota, Oklahoma, Texas, Washington, Oregon, and California.—Ed.]

A New Species of Deschampsia.—

Deschampsia **congestiformis.** sp. nov. Culmi erecti, tenues, 45–70 cm. alti, scabri supra; laminae culmi 4–8 cm. longae, 2–3 mm. latae, nervis supra prominentibus et hirsutissimis; folia basalia 10–30 cm. longa, ligula 1–2 mm. longa; panicula spissa, 6–12 cm. longa; spiculae appressi, 7–10 mm. longae; glumae aequales, scabrae in marginibus et in nervis mediis; lemmata glabra; capillae in callo 1½–3 mm. longae; aristae 5–7 mm. longae, tortae et flexae; rachilla hirsutissima.

Culms erect, slender, 45–70 cm. tall, scabrous above; culm-leaves 4–8 cm. long, 2–3 mm. wide, nerves prominent on upper surface and densely hirsute; basal leaves flat or folded, 10–30 cm. long, ligula 1–2 mm. long; panicle condensed, 6–12 cm. long; spikelets appressed, 7–10 mm. long; glumes equal, scabrous on margins and midrib; lemma glabrous, 7–8 mm. long; callus-hairs ¼ as long as lemma; awn 5–7 mm. long, twisted and bent, rachilla densely hairy.

In general aspect *D. congestiformis* does not resemble any of our other named species. It differs in particular from *D. elongata* (Hook.) Munro in that the leaves are not filiform and the lemmas are 7–8 mm. long rather then 4–6 mm. long. It differs from our only other American species with a narrow contracted inflorescence, *D. holciformis* Presl. in being less robust throughout and by having a bent, twisted awn.

Type specimen in herbarium of Montana State College, No. 32040. Collected by P. H. Hawkins in Gallatin valley near Bozeman, Montana, July 15, 1903. Isotypes in herbarium of University of Kansas and Gray Herbarium.—W. E. Booth, Department of Botany, Montana State College.

[1] Hopkins & Waterfall, Notes on Oklahoma Plants. Rhodora 45: 117. 1943.

Photo. B. G. Schubert.

Clematis Fremontii: figs. 1–3, leaves, × 1, from type-series from Ellis, Kansas; fig. 4, achene and base of tail, × 10

Photo. B. G. Schubert.

CLEMATIS FREMONTII: FIG. 1, upper leaf and flower, × 1, from Ellis, Kansas; FIG. 2, leaf denuded flower, × 1, of var. *Riehlii* from Allenton, Missouri; FIG. 3, leaf and young fruit, × 1, Franklin, Missouri, identified by its author as var. *Riehlii*

THE DATE OF PUBLICATION OF PURSH'S FLORA AMERICAE SEPTENTRIONALIS.—Frederick Pursh's *Flora Americae septentrionalis; or, a systematic Arrangement and Description of the Plants of North America* (2 vols., octavo; London) is dated "1814" but its citation by Ker-Gawler in *Bot. Mag.* t. 1596 (1 Nov. 1813) has led to the assumption that volume **1** (pp. i–xxxvi, 1–358, pls. 1–16) appeared late in 1813, certainly before November, 1813. Hence the name *Lophiola aurea* Ker-Gawl. (1 Nov. 1813) has been replaced in some works by *L. americana* (Pursh) Wood based on the apparently earlier *Conostylis americana* Pursh. Nevertheless in *Torreya* **4:** 134 (1904) Dr. J. H. Barnhart concluded that it was altogether probable that the two volumes were first offered for sale, together, some time during the month of January, 1814.[1] He reached this conclusion by correlating the mutual citations of Pursh's *Flora* and the *Botanical Magazine* (London). Further evidence confirms this. Evidently Pursh and Sims, the editor of the *Botanical Magazine*, were on terms so friendly that Sims made use of the *Flora* while still in proof. Pursh's *Flora* is cited in the *Botanical Magazine* up to t. 1583 (1 Sept. 1813) as "inedit." and under t. 1592 (1 Nov. 1813) as a "valuable flora, speedily to be published." Pursh himself in his addenda and corrigenda (vol. **2,** pp. 744–751) cites *Bot. Mag.* t. 1602 (1 Dec. 1813), indicating that on 1 December, 1813, the printing was not quite completed. Up to 1 January, 1814 (tt. 1606, 1607), Pursh's work is referred to as "*Fl. Bor.-Am.*" This indicates that previous to this date the editor of the *Botanical Magazine* had not seen the published title-page with its use of "septentrionalis" instead of "borealis". From 1 March, 1814, onwards (t. 1625) he cites it correctly as "*Fl. Amer. Sept.*" Thus the published work became available between the preparation of *Bot. Mag.* t. 1607 and t. 1625, i. e. between December, 1813, and February, 1814. Confirmation of the appearance of the two volumes together in January, 1814, is supplied by the London periodical *Monthly Literary Advertiser*, no. 105, p. 2 (10 Jan. 1814) which lists them among new publications. Uncoloured copies cost £1/16/—. Copies with coloured plates cost £2/12/6; they are rare but alone do justice to the artist's skill. The plates were drawn and engraved by William

[1] See also Fernald, RHODORA **40**: 344 (1938).

Hooker (1779–1832) who was the leading pomological artist of his day and a pupil of Franz Andreas Bauer; he also illustrated Salisbury's *Paradisus Londinensis*.—W. T. Stearn, London, England.

An unusual Habitat for Cuscuta compacta.—*Cuscuta compacta* is familiar to New England botanists as a parasite on shrubs of all kinds in swamps and on pond-shores, chiefly in the regions (*e. g.* eastern Massachusetts and the sand-plains of the Connecticut valley) inhabited by the more austral elements of our flora. It was therefore rather surprising, last year, to find a vigorous growth of it on stems and petioles of Japanese ivy (*Parthenocissus tricuspidata* (Sieb. & Zucc.) Planch.) on the walls of the Gray Herbarium building near the main entrance. The colony continues to flourish this year, without visible harm to the ivy, except that leaves in the immediate vicinity of the *Cuscuta* tend to fall early. This may well be the first record of *C. compacta* as a garden weed.

The nearest stations for the species represented in the Gray Herbarium and that of the New England Botanical Club or recorded in the Flora of the Boston District are: Middlesex Fells, Lexington, Waltham, Wellesley, Milton and Hingham. The minimum distance is four or five miles. How the rather heavy seeds of the *Cuscuta* could get to Cambridge from any of them is a question on which I can throw no light. It seems improbable that the highly sophisticated starlings which constitute the principal avifauna of the Gray Herbarium walls have ever penetrated feral swamps. And though the seeds might have arrived with dried specimens and been discarded with old papers, it is not usual at the Gray Herbarium to throw such rubbish out the front door—and there is no *Cuscuta* at the back.—C. A. Weatherby, Gray Herbarium.

Volume 45, no. 537, including pages 333–356, was issued 11 September, 1943.

NOV 16 1943

Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. November, 1943. No. 539.

CONTENTS:

Microchemical Studies on the Genus Cladonia, Subgenus Cladina.
Alexander W. Evans. 417

Carunculate Seed Dissemination by Ants. *Burton N. Gates.* ... 438

Virginian Botanizing under Restrictions (continued).
M. L. Fernald. 445

Vicia tetrasperma, Var. tenuissima in America. *M. L. Fernald.* 480

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton. Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

H pl. 783-795

Photo. B. G. Schubert.

PHYSOSTEGIA ABORIGINORUM, all figs. from TYPE: FIG. 1, plant, × ½; FIG. 2, flower, × 2; FIG. 3, fruiting calices, × 5

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. November, 1943. No. 539.

MICROCHEMICAL STUDIES ON THE GENUS CLADONIA, SUBGENUS CLADINA[1]

ALEXANDER W. EVANS

The species of *Cladonia* are distinguished from one another not only by morphological differences but also in many cases by differences in the lichen-acids and related substances which they produce. In the subgenus *Cladina*, for example, it has long been known that *C. rangiferina* (L.) Web. produces atronorine and fumarprotocetraric acid but that *C. sylvatica* (L.) Hoffm., although agreeing with *C. rangiferina* in forming fumarprotocetraric acid, differs in producing usnic acid instead of atronorine. Each of the other species of *Cladina* produces one or two of the three substances mentioned but no species, according to our present information, produces all three.

Prior to the introduction of Asahina's microchemical methods (see Evans, **13**) several additional lichen-substances had been found in the *Cladinae* by Zopf and by Hesse (see Sandstede, **14**) and some of these had been given names, such as cornicularine, erinacine, laxiuscine, and sylvatic acid. Unfortunately these substances were not fully characterized, and later writers have failed to identify them with any degree of certainty.

One of the first to apply Asahina's methods to a species of *Cladina* was Duvigneaud (**5**), who examined Belgian specimens of *C. impexa* Harm. He extracted his material with choloroform and treated the residue left after evaporation with Asahina's

[1] Contribution from the Osborn Botanical Laboratory. The writer wishes to thank Professor Alexander Petrunkevitch for the photographs used in Figs. 1, 2 and 6, and Dr. Robert T. Brumfield for the photograph used in Fig. 4.

G. E. solution.[1] In his preparations he found not only the characteristic crystals of usnic acid but also those of another substance, which he described as arborescences formed by aggregation of colorless curved needles. He expressed the opinion that this substance might be the same as erinacine, which was obtained from a form of *C. impexa*, but left the matter in doubt. Duvigneaud obtained identical crystals, unaccompanied by usnic acid, from another Belgian *Cladonia* which was morphologically like *C. impexa.* He considered the absence of usnic acid a sufficient reason for separating this plant from *C. impexa* and described it as a new species under the name *Cladonia subimpexa.*

The results of Duvigneaud's studies were published in 1939, and later in the same year des Abbayes' monograph of the subgenus *Cladina* (**4**) made its appearance. In this important work the author utilized Asahina's methods for the demonstration of atronorine and usnic acid in the *Cladoniae* and emphasized the value of paraphenylenediamine, usually designated by the letter P, for the detection of fumarprotocetraric acid. In discussing *C. subimpexa,* des Abbayes showed that the production of usnic acid is increased in strong sunlight but that species normally forming this substance may contain only a small amount or even none at all if growing in the shade (**4,** p. 17). He therefore interpreted *C. subimpexa* as a shade-form of *C. impexa* and reduced it to synonymy under f. *exalbescens* (Vainio) des Abbayes (**4,** p. 79).

In 1940 Asahina (**3**) applied his methods to the following representatives of the subgenus: *C. impexa, C. pseudoevansi* Asahina (a species proposed as new), *C. Evansi* des Abbayes (see **4,** p. 71), and *C. alpestris* (L.) Rabenh. In the first three he was able to demonstrate the presence of perlatolic acid, a substance originally extracted from *Parmelia cetrarioides* Del. var. *typica* DR. (see Asahina **2,** p. 40). This substance in the G. E. solution forms characteristic crystals, which are perhaps the same as those found by Duvigneaud in *C. impexa.* Asahina, however, does not suggest that perlatolic acid is identical with any of the substances previously reported in the *Cladoniae.* According to his results the acid is associated with usnic acid in *C. impexa* and *C. pseudoevansi* and with atronorine in *C. Evansi.*

[1] Composed of one part of glycerine and three parts of glacial acetic acid.

Asahina's study of *C. alpestris*, another species producing usnic acid, was based on two series of specimens which differ in their reaction to P. In one series this reagent gives rise to a distinct yellow color; in the other it produces no color change whatever. Plants showing the first reaction had already been observed by des Abbayes, who had separated them from the rest of the species as f. *aberrans* (**4**, p. 93). He suggested that the substance causing the yellow color might be psoromic acid, and Asahina by means of his microchemical methods was able to prove that this was the case. According to our present knowledge f. *aberrans* is the dominant form of *C. alpestris* in Japan. It occurs also as a rarity in North America but is unknown in Europe.

Asahina's material of *C. alpestris* showing the P— reaction consisted of 15 specimens from Europe, 3 from North America, and 3 from Japan. The specimens from Europe and North America were selected from Sandstede's *Cladoniae* exsiccatae. His preparations were obtained by extracting fragments of the podetia with acetone and by adding the G. E. solution to the dried residue. After the application of gentle heat two types of crystals, which he described as colorless, made their appearance. Since the chemical nature of the substances forming the crystals was unknown to him he designated them by the letters A and B, respectively. According to his brief descriptions crystals of type A, represented by his fig. 8, look like snow-crystals, whereas those of type B, represented by his fig. 9, are in the form of needles aggregated into radiate or tail-like clusters. He compared the latter with the crystals of psoromic and perlatolic acids but stated that they differed from those of psoromic acid in their P— reaction. Unfortunately he neglected to point out any distinctions between crystals of type B and those of perlatolic acid, and the examples shown in fig. 9 are hardly distinguishable from the crystals of perlatolic acid shown in his figs. 1, 5 and 6.

With the exception of *C. pseudoevansi*, which is known only from Japan, the writer has re-examined the species of *Cladina* studied by Asahina and has been able to confirm his statements regarding *C. impexa*, *C. Evansi*, and *C. alpestris* f. *aberrans*. In the case of P— specimens of *C. alpestris*, however, four different kinds of crystals, instead of two, made their appearance in the G. E. solution, in addition to the crystals of usnic acid. These

crystals were obtained from the numbers of Sandstede's *Cladonias* exsiccatae cited by Asahina, supplemented by other specimens from Europe and North America. In some cases the best precipitation occurred after the preparations had been left standing for several hours, although certain crystals could be demonstrated in the course of a few minutes. Of the four types of crystals found one is clearly the same as Asahina's type A, although it is not wholly without color. The second type, which occurs in over three-fourths of the specimens tested, is referred with considerable hesitation to Asahina's type B. This, too, shows a distinct coloration and differs in several respects from his description and figure. The third type, which is really colorless, is apparently distinct from any of the crystals heretofore found in the *Cladoniae* and may be designated by the letter C. The fourth type, also colorless, is identified with perlatolic acid, since it agrees essentially with the crystals of this substance obtained from *C. impexa* and *C. Evansi.* It is possible, however, that this fourth type may be the same as Asahina's type B.

The application of Asahina's methods to other species of the subgenus *Cladina* soon made it evident that crystals of types A, B, and C are not confined to *C. alpestris.* In *C. mitis* Sandst., for example, according to its present delimitation, all three types occur, type A is found also in *C. sylvatica* (L.) Hoffm. and *C. tenuis* (Floerke) Harm., and type B may be associated with perlatolic acid in *C. impexa.* Attention may be called also to the colorless crystals of another substance which appeared in certain preparations of *C. mitis.* These crystals, which may be tentatively designated by the letter D, resemble the crystals of diffractic acid, as figured by Asahina (**1,** f. 31), but are apparently not identical with them.

The lichen-substances now definitely known in the *Cladinae* are the following: atronorine, fumarprotocetraric acid, perlatolic acid, psoromic acid, usnic acid, and the substances forming crystals of the types A, B, C, and D. To these may be added rangiformic acid, which has been reported in *C. mitis* by Asahina (see Sandstede, **15,** p. 91), and further investigations will undoubtedly bring still other substances to light. Asahina's methods for the demonstration of the first five substances listed have already been summarized by the writer in another connec-

tion (**13**), but the following descriptions of crystals A, B, C, and D, together with the additional data on the crystals of perlatolic acid, may be of interest to the student. It is hoped that these descriptions, although incomplete, may enable the taxonomist to recognize the various substances under consideration.

Crystals of type A

The crystals, which are here referred to type A, have a yellowish brown color, varying considerably in shade. They apparently

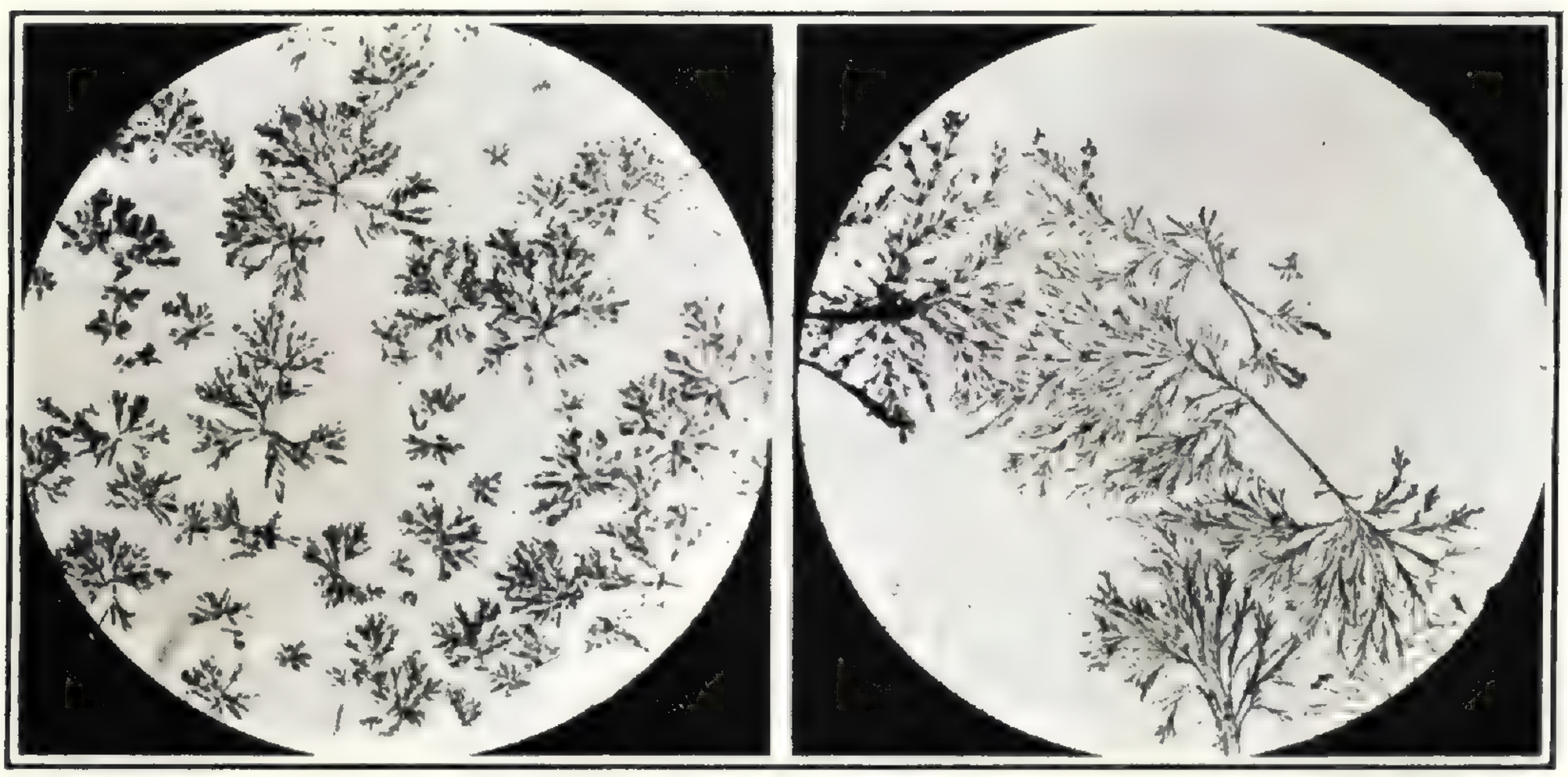


Fig. 1 Fig. 2

Fig. 1. Crystals of type A, × 42. Obtained from a specimen of *C. alpestris*, collected in 1933 by Torrey on North Mountain, Green County, New York, No. C-50.

Fig. 2. Crystals of type B, × 20. Obtained from a specimen of *C. alpestris*, collected in 1926 by Federov near Twer, Middle Russia, and distributed in Sandstede's *Cladoniae* exsic., No. 1714.

always occur in clusters. These, in their more typical form (Fig. 1) are radiate and show a superficial resemblance to snow-crystals but the rays, which may be simple or variously subdivided, are irregular and vary in number from five to ten. The width of the largest clusters observed was about 100μ, but it is rare for the width to exceed 60 μ. From the larger clusters, which are similar to those figured by Asahina (**3,** f. 8), there are all gradations in size down to the smallest clusters, which are barely 5 μ in diameter. In the smaller clusters, the rays are shorter, blunter, and less distinct than in the larger clusters and may not

be present at all. Under such circumstances the clusters form spherical or ellipsoidal masses. The crystals are so closely compacted in the clusters that it is difficult to determine their actual shape. They appear, however, to be in the form of needles or short rods, and in some cases an individual crystal projects from a cluster as a short pointed prism or flat plate 4–6 μ in width.

The formation of the crystals of type A is in many cases preceded by the appearance of yellowish areas in the preparations. These are mostly confined to the periphery, just within the edge of the cover-glass. The areas contain a profusion of minute oil-like droplets, suspended in a liquid, and it is possible that these may play a part in crystal-formation. As the crystals are precipitated in the yellowish areas the clusters may become surrounded by clear zones or halos. Many of the clusters, however, are not associated with the yellowish areas but are precipitated nearer the center of the preparation. Such clusters tend to be larger than those at the periphery and to show a more typical radiate arrangement.

Crystals of type B

The crystals of type B, according to the writer's interpretation, likewise show a yellowish or yellowish brown color but of a paler shade than in type A. Here, too, the crystals are united into clusters and these in their more characteristic development are in the form of complex branch-systems (Fig. 2), spreading out from a more or less definite point. In typical cases the main axes have a width of only about 1 μ and are scarcely if at all wider than the ultimate branchlets. Some of the largest and most elaborate branch-systems seen were over 2 mm. long, but these are exceptional and the smallest and simplest clusters are barely 30 μ long. The branching in general might be described as repeatedly pinnate, although examples of dichotomy are not infrequent. In the larger clusters branching takes place at intervals of 2–15 μ.

Although in normal examples the ultimate branchlets of a cluster taper to distinct points, there are cases in which a branchlet of this character is connected with a long yellow prismatic crystal having a width of 5–15 μ. Such a crystal broadens out gradually from a narrow base and then tapers more abruptly to

a point. In all probability it represents a crystal of usnic acid with which a crystal of the B type has coalesced. This hypothesis is supported by the fact that clusters of the B type may be attached by their bases to crystals of usnic acid, as shown by two of the large clusters in Fig. 2, both of which are attached to the same crystal at opposite ends. In combinations of usnic acid with clusters of the B type, the crystals of the latter are usually wider and show a more distinct yellow color than in normal clusters. The greater width, which may be as much as 5–6 μ, is found not only in the basal portion of a branch-system but also in branches of various ranks, including even the ultimate branches in clusters that are relatively simple. Apparently crystals of the B type are modified in some way by association with crystals of usnic acid, but it is difficult to determine how this is brought about. Since, however, the substance B is known only in species which produce usnic acid, the conditions for associations of this character seem to be always present.

The formation of crystals of type B may be preceded by the appearance of yellowish areas at the periphery of a preparation, similar to those described under type A. In these areas it is not unusual for a branch-system to extend inward from the edge of the cover-glass, and the clusters may be confined to this position, particularly if only a small amount of substance B is present. It may be noted also that crystals of usnic acid extending toward or into the yellowish areas are especially likely to become attached to clusters of type B. The individual crystals of a cluster are in the form of needles but it is difficult to tell where one crystal ends and another begins.

Crystals of type C

The crystals of type C are usually united in clusters but in rare instances isolated crystals can be demonstrated. These are in the form of thin navicular lamellae, pointed at each end and in some cases showing a slight sigmoid curvature (Fig. 3, a). Although the crystals may measure as much as 40–50 μ in length by 10–12 μ in width, most of them are considerably smaller. On account of its extreme transparency an isolated crystal is easily overlooked, particularly if it turns one of its faces toward the spectator. The clusters, fortunately, are more conspicuous and

stand out as grayish masses in a field dominated by the yellow crystals of usnic acid. In their simplest arrangement two to many crystals unite by their apices and form subcircular groups about 15 μ in diameter. The crystals under these circumstances show their edges and appear as slender rods or needles, in most cases variously curved or distorted. This indicates that they are not necessarily plane lamellae. If the curvatures are in one

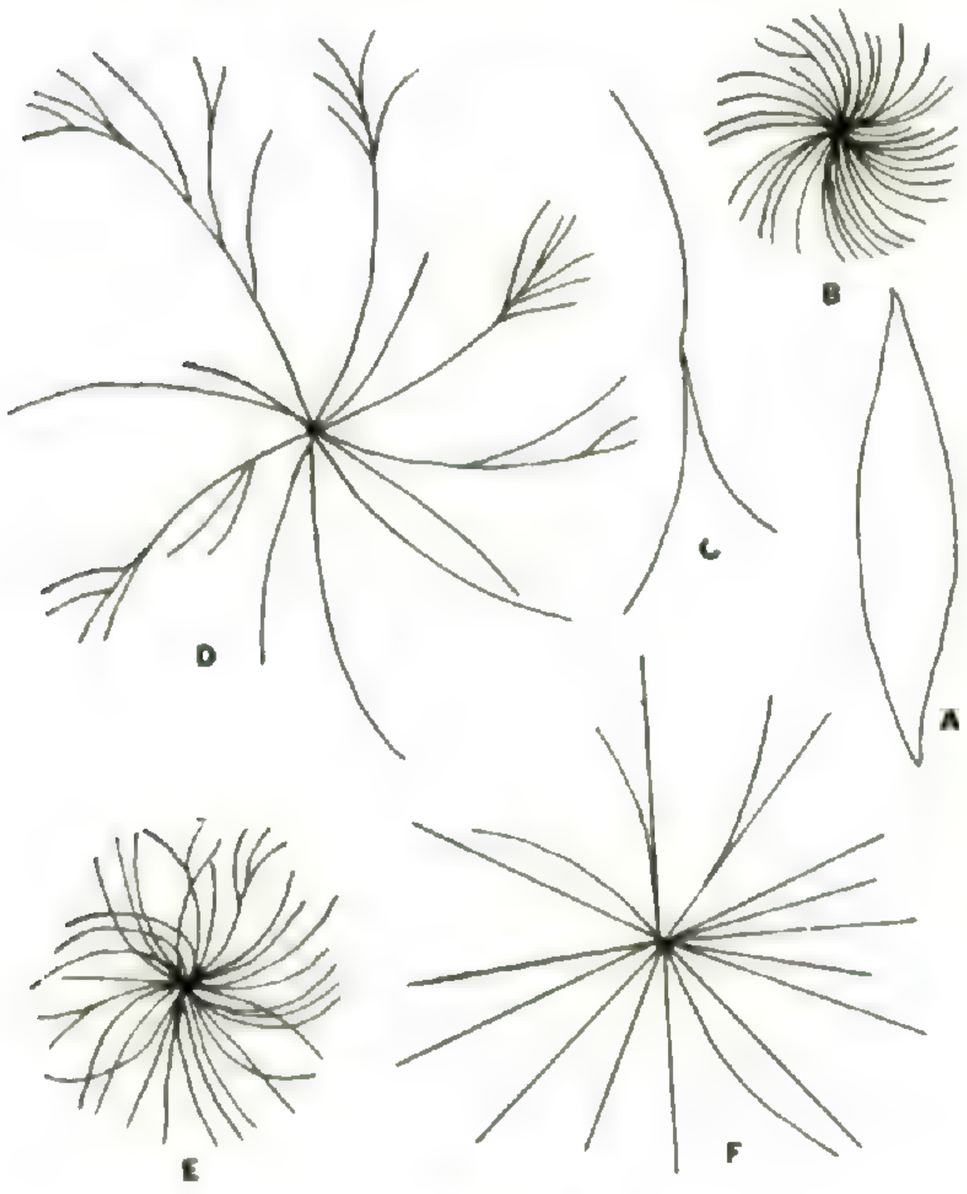


FIG. 3

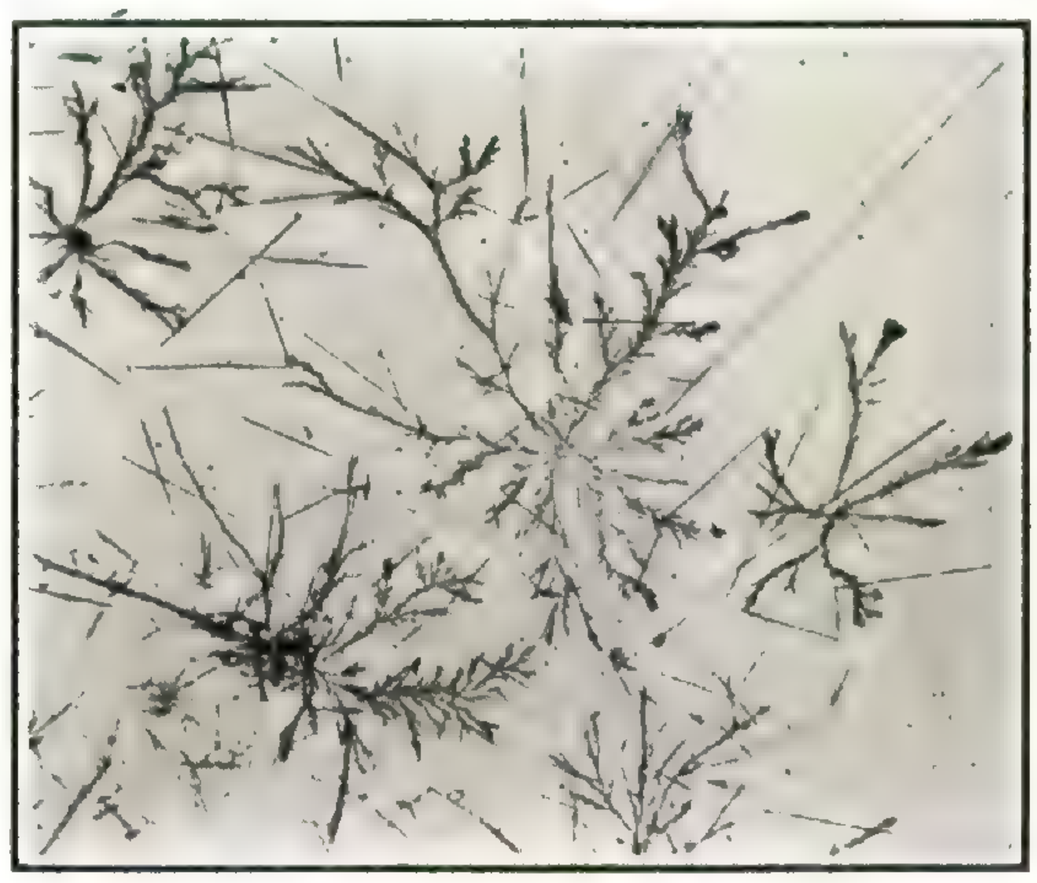


FIG. 4

FIG. 3. Crystals of type C, × 200. Obtained from a specimen of *C. submitis*, collected by the writer in 1932 at Killingworth, Connecticut, No. 3120.

FIG. 4. Crystals of type C and of usnic acid, × 28. Obtained from a specimen of *C. submitis* f. *prolifera*, collected by the writer in 1941 at Brooklyn, Connecticut, No. 5181a.

direction the cluster exhibits the characteristic appearance shown in Fig. 3, b. This regularity, however, is far from constant and the crystals, particularly in the more crowded clusters, may be curved in various directions (Fig. 3, c, d, e). Clusters in which many or all of the crystals appear straight are likewise not infrequent (Fig. 3, f).

In marked contrast to the clusters showing a subcircular outline are the much larger, irregularly radiate clusters (Fig. 4), which are occasionally produced. These bear a certain resemblance to the aggregates formed by the crystals of types A and B, but are at once distinguished by their total lack of color. The

radiate clusters vary greatly in size and the largest measured had a diameter of 0.25–0.3 mm. The rays are unequal in length and may be simple or variously subdivided. The axis of a ray, which has a width of about 6 μ, apparently consists of a row of overlapping and coalescent crystals, and upon this axis, throughout the greater part of its length, smaller and variously curved crystals are deposited. These may be scattered but tend to be crowded toward the extremities of the rays.

In some cases a third type of cluster appears at the periphery of a preparation, just within the edge of the cover-glass. The axis here consists of curved crystals seen on edge and attached end to end in such a way that an irregular branch-system is formed. Toward the interior of the preparation some of the branches may gradually broaden and become covered over with smaller crystals, thus acquiring the features of the rays of the radiate clusters.

Crystals of type D

In type D some of the crystals are in the form of exceedingly thin lamellae, others in the form of needles, and between these two extremes are numerous intergradations. In most cases the crystals are combined in clusters, and these may be large enough to extend completely across the field of the microscope. Even the largest clusters are easily overlooked on account of their extreme transparency, and the smaller clusters, which occur far more frequently, are still more inconspicuous. In some of the preparations small groups of lamellate crystals or even individual crystals can be demonstrated (Fig. 5, a). These are bounded by straight lines and are longer than broad with parallel sides. The ends may be bounded by two lines meeting at an obtuse angle or by continuous lines meeting the sides squarely or obliquely. Compound crystals are occasionally met with (Fig. 5, b). In the examples studied the lamellae varied in width from 2 μ to 50 μ and one of the largest seen had a length of 0.2 mm. In many instances the process of crystallization is incomplete and the bounding lines are zig-zag or otherwise irregular.

When the lamellae are seen on edge they appear as thin lines, which may be straight but which more frequently are curved in the form of a "C", showing that the crystals may be concave.

In clusters composed of lamellae alone the crystals may be superimposed upon one another (Fig. 5, c) or some of the crystals may be attached by their edges to the faces of other crystals. The latter condition is shown in Fig. 5, d, which represents two clusters composed of both lamellate and acicular crystals. It will be noted that the needles are attached to the lamellae at irregular intervals and that they form simple tufts or more elaborate branch-systems. In Fig. 5, e, a cluster composed entirely of somewhat shorter needles is shown. The cluster is in the form of a more or less pinnate branch-system, and even more complicated clusters of a similar type are not unusual. The needles of type D are in some cases so fine and delicate that they almost escape observation. A dense tuft of these exceedingly fine needles may show a pale brownish shade, although the majority of the clusters appear absolutely colorless.

In the subgenus *Cladina* crystals of the D type seem to be restricted to *C. mitis*. In the subgenus *Cenomyce*, however, the writer has demonstrated their presence in certain specimens of *C. rangiformis* Hoffm., a close relative of the common and widely distributed *C. furcata* (Huds.) Schrad. The crystals were found, for example, in Nos. 350, 490, 563, 684, 686, and 688 of Sandstede's *Cladoniae* exsiccatae, coming from various localities in northern and central Europe, although they were lacking in No. 173 from Norway and in No. 546 from Brandenburg. These data are sufficient to show that the substance D may be regarded as an accessory component of *C. rangiformis*. According to Zopf (**16,** p. 89) rangiformic acid also is a substance which may or may not be present in *C. rangiformis*, and Asahina (as already noted) has demonstrated the presence of this acid in *C. mitis*. It would of course be premature to suggest that there is any connection between the substance D and rangiformic acid, and yet it would not be surprising if further investigations proved them to be identical. Unfortunately, according to Asahina, rangiformic acid can not be demonstrated by microchemical methods.

CRYSTALS OF PERLATOLIC ACID

The crystals which perlatolic acid forms in the G. E. solution have been described by Asahina (**2,** p. 40). According to his account they are colorless and in the form of needles arranged in

bundles, which are grouped in irregular radiate clusters. These are clearly represented in his original figure (**2,** pl. 1, f. 3), which was based on preparations obtained from *Parmelia cetrarioides* var. *typica.* They are equally well shown in preparations obtained from *Cladonia impexa*, *C. pseudoevansi*, and *C. Evansi* (**3,** f. 1, 5 and 6). In the writer's experience the radiate clusters are usually precipitated at some distance from the edge of the cover-glass. The crystals of which they are composed are in the form

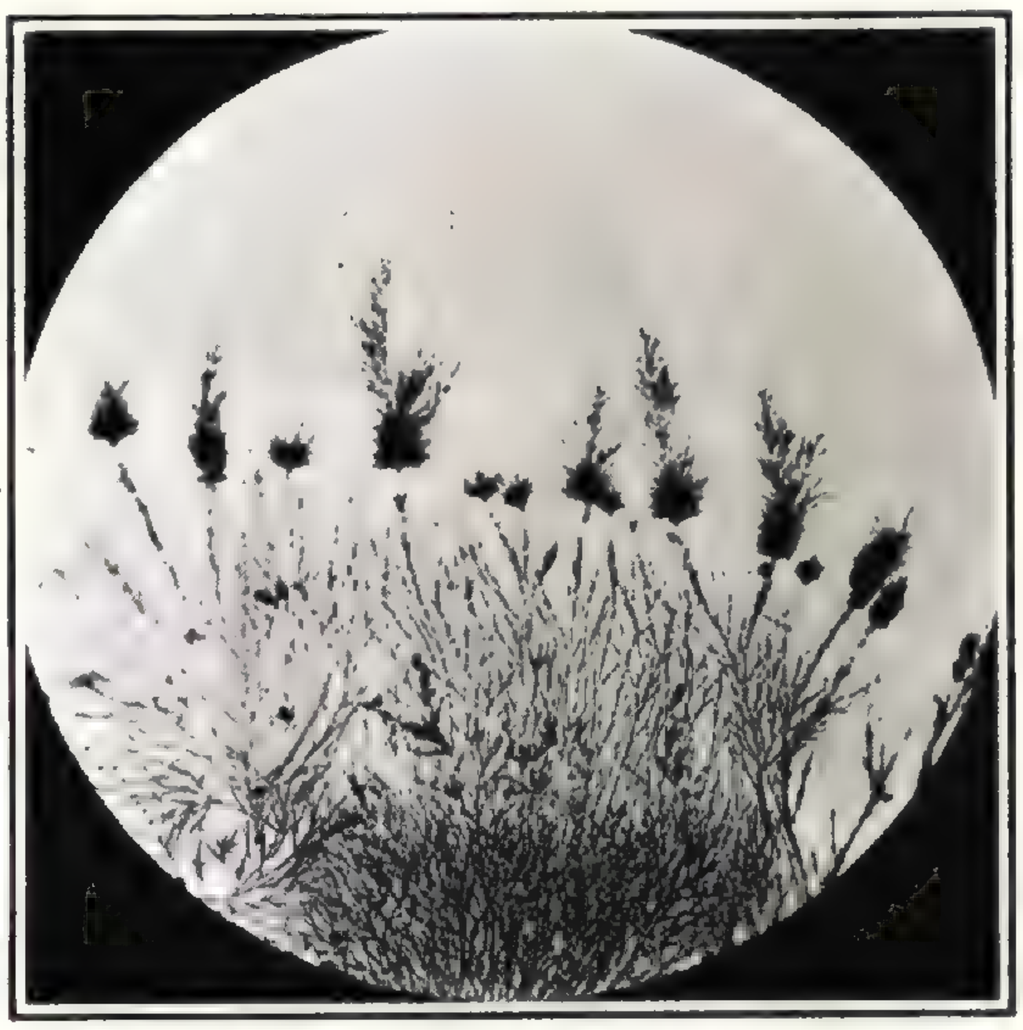


FIG. 5 FIG, 6

FIG. 5. Crystals of type D, × 200. Obtained from a specimen of *C. mitis*, collected in 1941 by Luttrell on Bald Knob, Giles County, Virginia, No. 2683.
FIG. 6. Crystals of perlatolic acid, × 20. Obtained from a specimen of *C. alpestris*, collected in 1941 by Sheldon near Siasconset, Nantucket, Massachusetts, No. S-145.

of long straight needles or narrow prisms, varying in width from less than 1 μ to 20 μ. Many of the crystals are simple throughout their entire length but others branch, usually by forking, and this process may be repeated. In most of the clusters one or more of the broader prisms, which taper to slender points, become covered, especially toward their tips, with loose or dense masses of short secondary crystals in the form of straight needles.

At the periphery of a preparation a somewhat different type of crystal-aggregate may make its appearance. This consists of one or more axial crystals which extend inward at right angles or obliquely from the edge of the cover-glass (Fig. 6). An axial

crystal, which is prismatic in form, broadens out gradually from a narrow base to a width or 6–8 μ and then tapers more abruptly to a sharp point. Upon this crystal toward its inner end a loose or dense mass of short acicular crystals is deposited, similar to those associated with the broader prisms of the radiate clusters. Unless these secondary crystals are sparingly produced the tip of an axis becomes completely concealed. Toward the base of the axial crystals slender branches may be given off, in some cases very abundantly. These in turn may branch repeatedly and form loose and more or less interwoven branch-systems.

DISTRIBUTION OF LICHEN-SUBSTANCES IN C. ALPESTRIS

Although six different lichen-substances are now known in *C. alpestris*, usnic acid alone seems to be constant. In some specimens, indeed, this is the only lichen-substance that can be demonstrated, but such specimens are unusual. In most cases one or more of the other substances accompany the usnic acid, and if two or three are present these may occur in various combinations. In order to learn something definite about the distribution of lichen-substances in the species the writer has examined a series of specimens from Europe and a second series from North America.

The European specimens, all giving the P− reaction, include the following numbers from Sandstede's *Cladoniae* exsiccatae, under each of which the substances demonstrated are indicated by the letters A, B, and C, for the crystals designated by these letters, and by the abbreviation "Per.", for the crystals of perlatolic acid: 85 (B), 86 (B, Per.), 110 (A), 565 (A, B), 823 (A, B), 877 (B), 1020 (B), 1146 (A, B), 1232 (B), 1462 (B), 1463 (A, B), 1680 (B, C), 1701 (A, B), 1714 (B, Per.), 1715 (A, B, C, Per.), 1782 (A, B, Per.), 1797 (A, B, Per.), 1810 (A, B, C), and 1811 (A, B). These specimens came from various localities in central and northern Europe, and all but four (Nos. 85, 86, 1680, and 1715) are cited by Asahina (**3,** p. 190). No. 1715, which contains all four substances, was collected by Mrs. E. J. Dostojnova in northern Russia. Six additional European specimens were likewise examined, as follows: Utviken, Norway, *Sandstede* (B); Stegafyeld, Norway, *Sandstede* (B, C); Svalestein, Norway, *Havaas*, distributed in Lich. Norvegiae Occid. exsic., No. 76 (B);

Delarna, Sweden, *Holdsworth*, No. 6 (usnic acid only) and No. 7 (B); Tirol, *Arnold*, distributed as f. *inturgescens* Arnold in Lich. exsic., No. 1020 (A); and Bohemia, *Anders* (B, Per.).

These data show that substance A is present in 12 of the 27 specimens examined (about 46 per cent), B in 23 (about 85 per cent), C in 4 (about 15 per cent), and perlatolic acid in 6 (about 22 per cent). They show further that A and B accompany each other in 10 specimens (about 38 per cent) and that C and perlatolic acid are both accompanied by B. The figures given must not be accepted too literally. In some cases two or even three tests were required before characteristic crystals appeared, and it is therefore possible that some of the figures may be too low. At the same time they give a general idea of the distribution of substances A, B and C and of perlatolic acid in European material of *C. alpestris*.

The North American material of *C. alpestris* examined by the writer includes five specimens which give a yellow color with P and which therefore represent the following form:

CLADONIA ALPESTRIS f. ABERRANS des Abbayes, Bull. Soc. Sci. Bretagne **16** (fasc. 2): 93. 1939. In the citation of the specimens the lichen-substances present are indicated and the abbreviation "Ps." designates psoromic acid. ALASKA: White House Pass, *Heath*, 1903 (A, B, Per.). QUEBEC: Tadousac, *Torrey*, 1937 (B, Per., Ps.); Mt. Richardson, *Torrey*, 1937 (A, B, Per., Ps.). PENNSYLVANIA: Lake Shehawken, *Dix*, 1939 (A, B, Per., Ps.).[1] MICHIGAN: Carp Lake, Porcupine Mountains, Ontonagon County, *Nichols*, 1935 (A, Per., Ps.). Des Abbayes lists f. *aberrans* from Canada and from the island of St. Paul in the Bering Sea, as well as from Japan.

His record for Canada was based on Torrey's specimens from Quebec. It will be seen that psoromic acid has been demonstrated in four of the specimens listed. Repeated tests, however, gave negative results with the specimen from Alaska. This may have been due to the difficulty, which Asahina emphasizes, of detecting psoromic acid in the presence of an excess of usnic acid.

The North American material of *C. alpestris*, in which P produces no change in color, totals 119 specimens. These represent a distribution extending from Alaska and Labrador southward to Minnesota, Wisconsin, Michigan, and West Virginia. Seven of

[1] Reported as *C. alpestris* by Dix in Torreya **40**: 45. 1940.

the specimens were distributed in exsiccati, as follows:—Macoun, Lichenes exsic., No. 55, "common in Gaspé and on Anticosti, and in the Rocky and Selkirk Mountains; also north shore of Lake Superior, 1869," distributed as *C. rangiferina* var. *alpestris* (B). Cummings and Seymour, Decades N. Am. Lichens, No. 32, Wellesley, Massachusetts, 1891, distributed as *C. rangiferina* c. *alpestris* (A, B, Per.). Merrill, Lich. exsic., No. 6, Rockport, Maine, 1908 (A, B); No. 57, same locality, 1925 (usnic acid only). Sandstede, *Cladoniae* exsic., No. 667, Minnesota, *Fink*, 1894 (B); No. 1220, Rockland, Maine, *Merrill*, 1924 (A); No. 1567, Wareham, Massachusetts, *Robbins*, 1925 (B). The last three specimens are among those listed by Asahina (**3,** p. 190). Without enumerating the other specimens the distribution of substances A, B and C and of perlatolic acid may be summarized. Of the 118 specimens examined 56 (or about 47 per cent) were found to contain substance A, 79 (or about 76 per cent) substance B, 10 (or about 8 per cent) substance C, and 33 (or about 28 per cent) perlatolic acid. These numbers do not diverge very widely from the percentages 46, 85, 15, and 22, respectively, derived from European material.

The question now arises, what is the taxonomic significance of the various substances found in *C. alpestris?* In other words should plants producing the substance A, for example, be separated as a distinct variety or form from plants which do not produce this substance? This question might be answered in the affirmative: (1) if plants producing the substance A were also distinguished by morphological differences; (2) if they occupied a restricted geographical range; or (3) if the presence of A excluded B, C, or perlatolic acid, either singly or in combination. According to our present knowledge not one of these conditions is fulfilled. The writer suggests, therefore, that A, B, C and perlatolic acid, so far as *C. alpestris* is concerned, be regarded merely as accessory substances having no taxonomic significance.

Whether an exception should be made in the case of f. *aberrans* is also open to question. This form, to be sure, is characterized by a distinct color-reaction with P, but this depends simply upon the presence of psoromic acid. There are, unfortunately, no morphological features characterizing f. *aberrans*, and the psoromic acid may be accompanied by perlatolic acid, as well as

by the substances A and B. Since, however, f. *aberrans* is known only from North America and Japan, it perhaps deserves recognition on the basis of its restricted geographical distribution.

Distribution of lichen-substances in C. mitis

According to the results obtained by the writer usnic acid is the only constant constituent of *C. mitis*, the species agreeing in this respect with *C. alpestris*. The following account of the distribution of the other lichen-substances found in the species is based on 125 specimens from Europe, 524 from North America, and 4 from Chile and New Zealand. The species is known also from Asia and Africa (see des Abbayes **4,** p. 127), but the writer has seen no specimens from either of these continents.

The European material examined includes a long series from Sandstede's *Cladoniae* exsiccatae, 6 numbers from des Abbayes' Lichenes Gallici, and about 50 packets from other sources. In a large number of these specimens only usnic acid could be demonstrated. This was true of the following numbers from Sandstede's *Cladoniae* exsiccatae: 55 (the type of the species from Oldenburg), 56, 58, 59, 63, 64, 66, 68, 119, 120, 261, 295, 323, 566, 793, 794, 822, 984, 985, 1033, 1037, 1058, 1060, 1518, 1440, 1441, 1516, 1517, 1761, 1762, 1809, 1816, and 1817. The same result was obtained from 20 other specimens, giving a total of 53, or about 42 per cent of all the specimens examined. The following numbers of Sandstede's exsiccatae showed crystals of the A type, unaccompanied by either B or D: 57, 60, 61, 65, 67, 69, 117, 118, 121, 247, 402, 683, 717, 735, 795, 797, 983, 994, 1056, 1057, 1059, 1115, 1439, 1519, 1520, 1521, 1644, 1645, 1646, 1781, 1818, 1819, 1820, and 1869. Adding to these 17 other specimens in which only crystals of the A type could be demonstrated gives a total of 51. Crystals of the B type, accompanied by crystals of the A type were found in only 2 specimens, Nos. 1519 and 1647 of Sandstede's exsiccatae, representing less than 2 per cent. Nos. 324, 796, 1306, and 1696 of Sandstede's exsiccatae, together with 11 other specimens, yielded crystals of the D type, a total of 15, or about 12 per cent. In three cases both A and D were present. The number of specimens, therefore, in which crystals of the A type were demonstrated totals 56, or about 45 per cent.

Des Abbayes (**4,** p. 121) emphasizes the fact that an occasional

specimen of *C. mitis*, a typically P− species, turns yellow or pale reddish, particularly at the tips of the podetia, in the presence of this reagent. Although he mentions no definite specimens that give a yellow color, he lists the following numbers from Sandstede's exsiccatae in which he obtained a pale reddish reaction: 323, 792, 793, 994, 1056, 1603, 1748, 1750, 1761, 1820, 1860, and 1869. Seven of these are included in the lists given above and three are lacking in the writer's set of the exsiccatae, but Nos. 1603, 1860, and 1869 deserve especial mention. In No. 1603 a definite red color appeared upon the addition of P, indicating that this number (at least in part) represents *C. tenuis*, instead of *C. mitis*. No. 1860, on the other hand, gave a distinct yellow color in the presence of P and yielded characteristic crystals of psoromic acid when tested by Asahina's methods. This number was collected near Upsala, Sweden, by Hedlund in 1928. In No. 1869, which gave a similar yellow color, no crystals of psoromic acid could be demonstrated. Whether or not specimens of *C. mitis*, which give a yellow color with P, should be separated as a distinct form, comparable with *C. alpestris* f. *aberrans*, may be left for European students to decide. No specimens of this type have as yet been detected in North America.

The following numbers from des Abbayes' Lichenes Gallici showed the presence of perlatolic acid accompanied by substance B: 41 (distributed as f. *prostrata* Sandst.), 42 (distributed as f. *vesciculosa* Sandst.), 43 (distributed as f. *prostrata ad vesciculosam*) and 44 (distributed as f. *divaricata* Sandst. *ad vesciculosam*). These specimens were collected by des Abbayes in 1937 at le Pouliguen, Loire-Inférieure, France, where they grew closely intermingled. In commenting upon them Sandstede (**15,** p. 14) states that No. 42 bears a strong resemblance to "*Cl. impexa-spumosa*" and "*Cl. sylvatica-subpumosa*," implying that it is not distinguished by definite morphological features. Since perlatolic acid has not been found in any other material referred to *C. mitis* and since it represents a characteristic constituent of *C. impexa*, the writer suggests that these four numbers be transferred to *C. impexa*. The P− reaction would of course distinguish them from *C. sylvatica*, which is definitely P+.

The North American specimens in the Yale Herbarium, which have been referred to *C. mitis* are definitely P−. They fall

naturally into two groups, which differ from each other in the lichen-substances produced, in geographical distribution, and in certain morphological features. Specimens belonging in the first group do not differ materially from European material either chemically or morphologically. Some, for example, contain usnic acid only, whereas others yield in addition crystals of the A, B, or D type, either singly or in certain combinations. The material of this group exhibits a geographical distribution extending from Alaska and Arctic America southward through Canada, northern New England and northern New York to Oregon, Wyoming, Wisconsin, and Virginia.

Specimens belonging in the second group yield, in addition to usnic acid, crystals of the C type. These in some cases are accompanied by crystals of the A type but apparently never by those of either the B or D type. The range of the second group extends from the Cape Cod region southward, mostly near the coast, to Delaware, Virginia, and West Virginia. It is therefore much more restricted than that of the first group, and it may be noted also that specimens of either group rarely occur within the range of the other. The morphological features of the second group will be considered later.

The material of the first group, 186 specimens in all, includes the following specimens from exsiccati:—Merrill, Lich. exsic., No. 104, Rockland, Maine, 1909, distributed as *C. sylvatica* f. *morbida* (A). Sandstede, *Cladoniae* exsic. No. 1223, Rockland, Maine, *Merrill*, 1924 (A); No. 1469, Brandon, Vermont, *Dutton*, without date (A); No. 1476, Wareham, Massachusetts, *Robbins*, 1925 (A); No. 1749, Bourne, Massachusetts, *Robbins*, 1927 (usnic acid only); No. 1566, Jackson, New Hampshire, *Robbins*, 1924 (A, D); No. 1582, same station and collector, 1925 (A, D); and No. 1833, same station and collector, 1927 (usnic acid only). The enumeration of the other specimens may be omitted, as in the case of the North American material of *C. alpestris*, but the distribution of substances A, B and D may be summarized. Of the 186 specimens examined 125 (or about 67 per cent) showed crystals of type A, 9 (or about 5 per cent) crystals of type B, and 24 (or about 13 per cent) crystals of type D. The corresponding percentages for the European material were 45, 2, and 12. The marked discrepancy in the case of substance A is due to the fact

that the European material includes relatively more specimens containing usnic acid only, possibly because many of these specimens came from a restricted area.

The specimens examined from the Southern Hemisphere are the following:—CHILE: Port Marqueri, *Junge*, 1932 (A, B). NEW ZEALAND: near Atiamuri, Allison, 1931 (usnic acid only); same station and collector, 1932, two packets (B).

In estimating the taxonomic significance of the various lichen-substances in *C. alpestris* three criteria were suggested. If the same criteria are employed in the case of *C. mitis*, it might appear that plants containing substance B or substance D had certain claims for recognition as distinct forms. Although each of these substances may accompany A, they are apparently never found together. Plants containing B, moreover, are mostly northern or antarctic and plants containing D are in many cases smaller and more delicate than plants in which this substance is lacking. The substance B, in fact, is often present in specimens representing the northern and antarctic f. *laevigata* (Vainio) des Abbayes (**4,** p. 122), in which the pseudocortex is poorly developed; and the substance D in specimens representing f. *tenuis* Sandst. (**14,** p. 110). It would therefore be a happy solution of the problem if B could be definitely associated with f. *laevigata* and D with f. *tenuis*. There are reasons, unfortunately, why this can not be done. Certain plants containing B, for example, agree neither in range nor in their morphological features with f. *laevigata*, and certain plants containing D are too robust to be referred to f. *tenuis*. It thus seems advisable, under the circumstance, to regard substances B and D, as well as substance A, as accessory constituents of *C. mitis* and to assign to them no taxonomic importance.

The case is different with specimens containing the substance C. Although the morphological distinctions between these specimens and those belonging to the first group are slight and less definite than might be desired they are sufficient in the case of well-developed material for the separation of the groups. According to des Abbayes (**4,** p. 120) the sterile ultimate branchlets of the podetia in *C. mitis* are mostly in 2's or 3's, relatively long, slender, and (in most cases) curved. These features are more or less in evidence in European material and in North

American material belonging to the first group. In material containing the substance C, however, the ultimate branchlets present a different appearance. They are not only more numerous and shorter than in the first group but the curvature tends to be less marked. Many of the branchlets, in fact, are not curved at all. The podetia, moreover, tend to be more robust than in the first group. These slight morphological differences, the restricted geographical distribution of the second group, and the fact that the presence of C apparently excludes B and D afford a sufficient basis for the separation of the group from *C. mitis* as a distinct species, as follows:—

Cladonia **submitis,** sp. nov. Thallus primarius ignotus. Podetia typice straminea vel albido-straminea, sat robusta, caespitoso-conferta, longitudine vulgo 5–7 cm., crassitudine vulgo 1–3 mm., ad axillis saepe dilatata, parce dichotome, abundantius polychotome ramosa, base divisionibus inaequalibus axem sympodialem efficentia, ramis et ramulis ramosis, ramulis superioribus abbreviatis, rectis vel rarius nutantibus, impellucida, glabra vel subverruculosa, K−, P−, acidum usnicum et materiam "C" continentia.

Although *C. submitis* is not confined to sandy localities it shows a strong preference for areas in which sand is abundant. Under favorable conditions the podetia form compact and extensive colonies, in which the more centrally situated individuals are erect or ascending. In many cases, however, the podetia are prostrate or nearly so and are either scattered about on the substratum or form loose clusters. In some cases tufts of the species grow in mats of *Polytrichum.*

The material of *C. submitis* examined by the writer includes 338 specimens and in 80 of these, representing about 24 per cent, crystals of the A type are associated with crystals of the C type in the G. E. preparations. No. 1391 of Sandstede's *Cladoniae* exsiccatae, collected by Robbins at Wareham, Massachusetts, in 1924, may be designated the type of the species. This number was distributed as *C. mitis* m. *prostrata* Sandst. Other stations for the species are as follows:—

Vermont: Brattleboro, *Evans,* 1935; Halifax, *Evans,* 1939; Marlboro, *Evans,* 1939; and Putney, *S. M. Thomson,* 1942. These specimens are less robust than most of the material from farther south. Massachusetts: Brewster, *Evans,* 1929; Provincetown, *Evans,* 1930; Stoughton, *Blake,* 1931; Manchester,

Harris and *Smith*, 1934; Eastham, *Evans*, 1935, and *Torrey*, 1936; Wellfleet, *Evans*, 1935, *Torrey*, 1937, and *Logan*, 1937; Martha's Vineyard, *Torrey*, 1936, Craigsville Beach, *Torrey*, 1936; Cape Race, *Torrey*, 1936; South Chatham, *Torrey*, 1936; Nanset Coast Guard Station, *Torrey*, 1936; Nantucket, *Torrey*, 1937, and *Sheldon*, 1940; Centerville, *Torrey*, 1937; Clinton, *Harris et al.*, 1938; and Tuckernuck, *Sheldon*, 1938. Many of these stations in the Cape Cod region. RHODE ISLAND: South Kingstown, *Evans*, 1929. CONNECTICUT: stations previously listed by the writer under *C. mitis* (**6,** p. 381, **7,** p. 123, **8,** p. 36, and **9,** p. 8). NEW YORK: Fisher's Island, *Evans*, 1930; numerous stations on Long Island, *Torrey*, *Latham*, and *Cain*, 1933–1939; and Croton Aqueduct near Quaker Bridge, *Torrey*, 1937. NEW JERSEY: the stations previously listed by the writer under *C. mitis* (**10,** p. 86, **11,** p. 138, and **12,** p. 143). DELAWARE: Cape Henlopen and Reheboth, *Torrey*, 1936. VIRGINIA: Short Mountain, *Allard*, 1938, and *Luttrell*, 1942; and Ironto, *Gray*, 1940, and *Luttrell et al.*, 1941. WEST VIRGINIA: Petersburg, *Gray*, 1939.

The following forms of *C. submitis*, analagous to the similarly named forms of *C. mitis*, may be distinguished:—

CLADONIA SUBMITIS f. **divaricata** f. nova, podetia repitito verticillate ramosa.

No. 1565 of Sandstede's *Cladoniae* exsiccatae, collected by Robbins at Wareham, Massachusetts, in 1925, and distributed as *Cl. mitis* m. *divaricata*, may be designated the type of this form. No. 1750 of the same series, collected by Robbins at the same locality, in 1927, and distributed as *Cl. mitis-divaricata*, likewise belongs here. Other records follow.

MASSACHUSETTS: Wareham, *Robbins*, 1923 and 1924; Brewster, *Evans*, 1929; Centerville, *Torrey*, 1937; and Nantucket, *Sheldon*, 1940. RHODE ISLAND: South Kingstown, *Evans*, 1929; Watch Hill, *Evans*, 1935. CONNECTICUT: various stations previously listed by the writer under *C. mitis* f. *divaricata* (**6,** p. 383, and **8,** p. 36). NEW YORK: Fisher's Island, *Evans*, 1930; and Long Island, Latham, 1938. NEW JERSEY: the stations previously listed by the writer under *C. mitis* f. *divaricata* (**10,** p. 86).

CLADONIA SUBMITIS f. **prolifera** f. nova, podetia vulgo decumbentia, ramulis adventiciis brevibus plus minusve numerosis tecta.

This form may be typified by No. 1564 of Sandstede's *Cladoniae* exsiccatae, collected by Robbins at North Falmouth, Massachusetts, in 1924, and distributed as *Cl. mitis* m. *prolifera*. The following additional stations may likewise be cited:—

MASSACHUSETTS: Wareham, *Robbins*, 1923; Martha's Vineyard, *Harris*, 1934, and *Torrey*, 1936; Cape Race, *Torrey*, 1936; South Chatham, *Torrey*, 1936; and Merrimack, *Harris*, 1938. CONNECTICUT: the stations previously listed by the writer under

C. mitis f. *prolifera* (**6,** p. 383, **7,** p. 123, **8,** p. 36, and **9,** p. 8). NEW YORK: Long Island, *Torrey*, 1933, and *Latham*, 1934. NEW JERSEY: the stations previously listed by the writer under *C. mitis* f. *prolifera* (**10,** p. 86, **11,** p. 138, and **12,** p. 143). DELAWARE: Cape Henlopen, *Torrey*, 1936.

CLADONIA SUBMITIS f. **soralifera** f. nova, podetia farinoso-sorediosa, sorediis luteo-albis, in maculis circumscriptis. This form is known at present only from the following station:

CONNECTICUT: North Haven, *Miss Fulford*, 1932, previously listed by the writer (**8,** p. 37) as *C. mitis* f. *soralifera* Sandst.

DISTRIBUTION OF LICHEN-SUBSTANCES IN ALL THE SPECIES OF THE SUBGENUS CLADINA

Although several species of *Cladina* have not yet been studied critically by Asahina's methods a summary of our present knowledge regarding the distribution of the various lichen-substances found in the group may be of interest and is given in Table 1. In addition to the ten species listed by des Abbayes in his monograph (**4**) the list includes *C. pseudoevansii* and *submitis*. Following the example of its author the North American *C. tenuis* subspecies *subtenuis* des Abbayes is not separated specifically from *C. tenuis*. Of the species listed *C. leucophaea* is apparently confined to Europe and *C. pseudoevansi* to Japan. The remaining ten species have all been reported from North America, and Nos. 1, 4, 6, 8, 11, and 12 are widely distributed in other parts of the world. The sign + indicates a constant component, the sign ± an accessory component.

TABLE 1

	Atronorine	Fumarprotocetraric acid	Perlatolic acid	Psoromic acid	Rangiformic acid	Usnic acid	Substance A	Substance B	Substance C	Substance D
1. *C. alpestris* (L.) Rabenh.			±	±		+	±	±	±	
2. *C. Evansi* des Abbayes	+		+							
3. *C. fallax* des Abbayes		+				+				
4. *C. impexa* Harm.			+			+		±		
5. *C. leucophaea* des Abbayes		+								
6. *C. mitis* Sandst.				±	±	+	±	±		±
7. *C. pseudoevansi* Asahina			+			+				
8. *C. rangiferina* (L.) Web.	+	+								
9. *C. Sandstedei* des Abbayes	+	+								
10. *C. submitis* Evans						+	±		+	
11. *C. sylvatica* (L.) Hoffm.		+				+	±			
12. *C. tenuis* (Floerke) Harm.		+				+	±			

Literature Cited

1. Asahina, Y. Mikrochemischer Nachweis der Flechtenstoffe (II. Mitteil.). Jour. Jap. Bot. **12**: 859–872. 1936.
2. ———. Mikrochemischer Nachweis der Flechtenstoffe. V. Mitteilung. *Ibid.* **14**: 39–44. 1938.
3. ———. Mikrochemischer Nachweis der Flechtenstoffe. XI. Mitteilung. *Ibid.* **16**: 185–193. 1940.
4. Des Abbayes, H. Revision monographique des *Cladonia* du sousgenre *Cladina* (Lichens). Bull. Soc. Sci. Bretagne **16** (fasc. 2): 1–156. 1939.
5. Duvigneaud, P. Notes de microchemie liquénique, I. Sur deux *Cladoniacées* nouvelles. Soc. Roy. de Bot. de Belg. Bul. **71**: 192–198. 1939.
6. Evans, A. W. The *Cladoniae* of Connecticut. Conn. Acad. Arts and Sci. Trans. **30**: 357–510. 1930.
7. ———. Notes on the *Cladoniae* of Connecticut. Rhodora **34**: 121–142, 153–164. 1932.
8. ———. Notes on the *Cladoniae* of Connecticut—II. *Ibid.* **37**: 33–57. 1935.
9. ———. Notes on the *Cladoniae* of Connecticut—III. *Ibid.* **40**: 4–26. 1938.
10. ———. The *Cladoniae* of New Jersey. Torreya **35**: 81–109. 1935.
11. ———. The *Cladoniae* of New Jersey—Supplement. *Ibid.* **38**: 137–149. 1938.
12. ———. The *Cladoniae* of New Jersey—Second Supplement. *Ibid.* **40**: 141–165. 1940.
13. ———. Asahina's microchemical studies on the *Cladoniae*. Torrey Bot. Club Bull. **70**: 139–151. 1943.
14. Sandstede, H. Die *Cladonien* des nordwestdeutschen Tieflandes und der deutschen Nordseeinseln. III. Abhandl. Naturw. Ver. Bremen **25**: 89–243. 1922.
15. ———. Ergänzungen zur Wainio's "Monographia *Cladoniarum* universalis" unter besonderer Berücksichtigung des Verhaltens der *Cladonien* zu Asahina's Diaminprobe. Repert. Spec. Novarum Regni Veg. Beih. **103**: 1–103. 1938.
16. Zopf, W. Beiträge zu einer chemischen Monographie der *Cladoniaceen*. Deut. Bot. Gesell. Ber. **36**: 51–113. 1907.

CARUNCULATE SEED DISSEMINATION BY ANTS

Burton N. Gates

The caruncle-bearing seeds of the Large White Trillium and of the Bloodroot, have been shown to be disseminated by ants.[1] They are attracted by the caruncle, as a lure and a probable source of food. It was observed that the seeds were carried into the ants' nest, the caruncle removed, and the denuded seeds discarded outside of the nest. This the writer reported in Rhodora.

[1] Burton N. Gates, Dissemination by Ants of the Seed of *Trillium grandiflorum*. Rhodora, 1940. vol. 42, p. 194.

Ibid. Observations in 1940 on the Dissemination by Ants of the Seeds of *Trillium grandiflorum*. Rhodora, 1941, vol. 43, p. 206.

Ibid. Dissemination by Ants of the Seeds of Bloodroot, *Sanguinaria canadensis*. Rhodora, 1942, vol. 44, p. 13.

From these observations, it was anticipated that other caruncle-bearing seeds, likewise attract ants as a food source and are ant-dispersed. By examining many kinds of seeds, a few were found with a caruncle. These were tested with ants for their reactions. The same general methods have been employed, as with the Trillium and the Bloodroot. All seeds were freshly gathered and handled with forceps to minimize contamination with foreign odors. These experiments were made at Worcester, Massachusetts.

Ricinus species

The Castor bean, *Ricinus sp.*, an exotic plant is generally known to have a huge caruncle. This foreign seed, it might be anticipated, would have no attraction for New England, common ant-species. Its habitat is considered to be Africa; possibly it is indigenous to tropical America and Asia. It is grown in the north-temperate zone for ornament, though not extensively. With it, our native ants can have had little more than a limited and recent experience. It is popularly thought to have properties repellent or perhaps poisonous to insects and animals. Beans placed in the tunnel of a mole are said to be repellent and poisonous. While gathering freshly ripened beans, a gardener told the writer, "ants never go near the Castor bean plants."

As a test, freshly collected beans were offered to various, undetermined ants on October 4, 1941, at several stations. Although the ant reactions were not absolutely negative, for a time it appeared that this carunculate seed might prove unattractive. Seemingly indifferent, some ants were seen to explore the seed and to tap the bean and caruncle with their antennae. To further test this slight reaction, and, because the seed is so mountainous as compared with the size of most of our common ants, the caruncle was removed and offered separately. This resulted in increased activity, but there was no apparent effort to carry off the caruncle. Finally, the hard, fibrous caruncle was crushed and broken with forceps. A trial piece brought immediate response; an ant carried away the first piece offered. Crushing doubtless expressed or released some of the oils which are thought to be the food elements in the caruncle which attract the ants. In succeeding trials, each ant which carried off a

piece of caruncle was caught for identification. The nine collected ants proved to be of one species, *Prenolopis imparis* Say.[1]

The reaction of the New England ants to the tropical Castor bean caruncle would indicate that in its native habitat, it too is a lure to ants in the dissemination of the seeds. It is the usual practice for an ant to carry the seed to the nest with the attached caruncle. Due to the disproportionate size of our ants to the greater bulk and weight of the seed of the Castor bean, the predominately small ant species, commonly found in this locality could hardly be expected to attempt this feat. On this feature Mr. Wesson commented in a letter, that in the tropics, where there is a wealth of ant species, "there would be many strong enough to transport this bean." He also ventured that in our northeastern States "this bean could be transported, although not with facility, by some members of the genera *Formica* and *Camponotus*". Although not yet demonstrated, it would appear from the ant reactions that the beans of the Castor bean plant in their natural habitat, doubtless may be disseminated by ants.

VIOLA

Various species of *Viola* seeds were found to be carunculate. Cleistogamous seeds of *Viola cucullata* Ait. on October 5, 1941 were ripening freely. During the warm part of the day, ants were working in and out of their nests. At the first station in a dirt path, where an experiment with these seeds was attempted, it was a surprise to find that the ants of this nest had already gathered violet seeds (doubtless *V. cucullata*). Resting lightly on the sandgrain cone of the entrance, apparently having been cast from the nest within the last few hours, twenty-four *Viola* seeds were picked up with the forceps. The caruncle of each seed had been gnawed off, a confirmation of ant behavior as determined in the early experiments with Trillium seeds. Three specimens of the ants of this nest, which had ejected the *Viola* seeds were identified by Mr. Wesson as *Lasius americanus*.

At a second station freshly gathered *Viola* seeds were placed adjacent to a small entrance. The head of an entrance-guard could be seen, practically closing the hole. As if by magic, the seeds disappeared into the nest, one by one. The guard was seen

[1] Mr. Lawrence G. Wesson, Jr., Boston, Massachusetts has generously made ant determinations in all of these experiments. His assistance is appreciated.

to emerge slightly, pick up a seed and disappear so quickly with it, that she virtually defied detection. Nine seeds were hastily taken in this way; the tenth was stolen and carried off by a strange ant. She was traced to her entrance, about two feet away, into which she disappeared with the seed. Two specimens from this nest were identified by Mr. Wesson as *Prenolopis imparis*.

Chelidonium majus

Celandine, *Chelidonium majus* L., was found on June 13, 1942 to be ripening seeds which were carunculate. They are small, about 1 mm. the long way. At the first station, seeds were shelled from a pod on to a flat stepping-stone where ants were crossing. The seeds at first attracted little attention; one small ant picked up the same seed on two occasions, carried it a short distance and dropped it. This hesitation was also observed on several occasions in the course of the trials. A slightly larger ant found the seeds and carried away eight of them in quick succession. Apparently, this was done by the same individual, judging from her searching behavior and her haste to find more seeds. No identification of the ant species was attempted in these tests with the Celandine seeds, the behavior being so uniform with that of the various species identified by Mr. Wesson.

At the second station, four seeds were promptly picked up from the dirt path. Seven to ten ants when offered a slightly opened pod placed on the ground, endeavored to extract seeds through the opening. At the third station, a pod which had been partially split open was placed on a path. Several ants of a larger species attacked it, forcing their way into and enlarging the cleft. In a brief period, ten seeds were removed and carried a short distance to the nest.

Referring to the first trials with Celandine seeds, several ants were observed to hesitate, as if to examine the seed which they had clutched. In some instances the seed was dropped and picked up again by the returning ant. Usually, it was carried away after a more or less extended examination. While no positive interpretation seemed possible, this behavior suggests either an unfamiliar food material, requiring some sort of determination by the ant, or an undetected attempt to remove the caruncle in the field. There is evidence of a process of

learning or becoming acquainted with a new and satisfactory food. Having recognized the good food, there appears to be a means of announcing the "find." The first Celandine seeds taken into the nest noticeably increased the nest activity at the entrance. Excitement was evident as ants hurried out in increased numbers, quite comparable to a recognized behavior of honeybees. It has been demonstrated that bees have a means of announcing a new "find" to the other workers in the hive, which results in increased hive-activity and a rush from the entrance. The ant behavior was quite comparable, as soon as the first few Celandine seed passed into the nest; excitement around the entrance was manifest. More and more ants emerged; more and more ants attempted to force their way into the split in the Celandine pod, removing seeds about as fast as they could be counted. By some means, the "find" of a quantity of Celandine seeds had become known quickly, to many workers.

DICENTRA SPECTABILIS

Bleeding Heart, *Dicentra spectabilis* Lem. (sometimes called *Dielytra spectabilis* in horticulture), self-sows widely in the writer's garden, suggesting to Mrs. Gates that this plant, like *Viola* and some weedy species might be disseminated by ants. She confirmed this August 30, 1942. The seeds are a glistening, polished black having a proportionately large "crest", as termed in Gray's Manual of Botany. The first seed which Mrs. Gates offered an ant was instantly taken; simultaneously, one she had placed on a stepping-stone disappeared. She fed various ants a pod of five seeds within a few minutes. All were readily accepted. The only other pods which could be found were not quite ripe. Slightly unripe seeds, lacking the lure, which may be odor, flavor, consistency, immaturity of the caruncle or some other quality, have no attraction for ants. This also has been observed with other species of seeds, in particular with Celandine seeds. August 31 a ripe pod was found. The seeds were offered to ants at a number of different stations. Because of the shortage of seeds at this late season, a few of them were recovered and used in more than one trial. Three positive reactions, each at a different station, were immediately obtained. At one station, an ant climbed into the match box in which the seeds were being carried,

stole a seed and made away with it before she could be captured. A series of seven positive reactions were then obtained; the fourth subject, however behaved unusually. This ant spent considerable time in an apparent effort to remove the carunculate "crest". She finally gave up the task and carried away the whole seed. Should this become a usual practice in the field, obviously, the primary function of the caruncle to bring about seed dispersal would be defeated. On the contrary, among the many observations, practically every ant appeared to be impelled to pick up the seed and carry it away in the greatest haste.

Summary

In mentioning the caruncle, the fact that a seed may have a minute, not visible caruncle has been disregarded. For the purpose of these experiments, a carunculate seed has a pronounced caruncle, visible and presumed to be ant food. In the search for carunculate seeds, all kinds of seeds have been examined. This has been necessitated, because the caruncle is seldom mentioned or indicated in taxonomic keys, as Gray's Manual. It appears possible, however, that seed characters, including the caruncle could be used to advantage in plant classification. For instance, the seeds of all Violas (no mention in Gray) thus far examined are carunculate: these caruncles and seeds appear to differ with the species and may be of taxonomic value.

In order to bring together and visualize these findings, a list of the seeds observed with a pronounced caruncle or aril, as well as those mentioned by Gray or elsewhere has been arranged; seeds used in the experiments with ants are indicated by an asterisk(*).

Family	Carunculate Trend	Species observed with Caruncle
Liliaceae	Verious genera with caruncle and aril	**Trillium grandiflorum* (Michx.) Salisb.
Nymphaeaceae	Ariled seeds in genus *Castalia*	
Anonaceae	Ariled	
Berberidaceae	With and without aril	

FAMILY	CARUNCULATE TREND	SPECIES OBSERVED WITH CARUNCLE
Papaveraceae	Many species with caruncle or crest	**Sanguinaria canadensis* L. **Chelidonium majus* L. *Macleaya cordata* (Willd.) R. Br.
Fumariaceae	Genera and species vary with and without crest, caruncle or aril: factors used in classification	**Dicentra spectabilis* Lem.
Polygalaceae	Species largely caruncu-late: used in classification	
Euphorbiaceae	Various genera and species with caruncle; used in classification	**Ricinus* sp. (probably *communis*)
Celastraceae	Mostly ariled	
Violaceae	Not mentioned in Gray's Manual (Seventh ed.) as carunculate. Carunculate seeds of *Viola blanda, incognita,* and *renifolia* are illus-trated in Baird—Wild Violets of North America, Berkeley, 1942, p. 160, but no mention is made in the text of the caruncle.	*Viola pedata* L. **cucullata* Ait. " forms, (two white-flowered forms in cultivation) *palmata* L. *fimbriatula* Sm. *lanceolata* L. *pallens* (Banks) Brainerd *blanda* Willd. *incognita* Brainerd *renifolia* Gray *odorata* L. (A single, white form with violet markings; fragrant) *pubescens* Ait. *tricolor* L. (Cultivated pansy) *tricolor* L. ("Johnny-Jump-up") *arvensis* Murr. "Jersey Gem", a horticultural variety

ANT SPECIES AND THE SPECIES OF CARUNCULATE SEEDS TO WHICH ANTS REACTED

During the tests covering several years, eight species of ants have responded to the caruncle of six species of seeds. As will be observed in the tabulation, a given species of ant reacted to one or to more than one species of seed. Since the tests were made at random, there is no indication that an ant species selected or

refused any particular species of seed. Instead, had it been possible to make the tests, it is not unlikely that the various ants would have responded to any of the various caruncles. It is likewise presumable that other ant species and other carunculate seeds would give comparable results.

Ants	Plants with Carunculate Seeds to which Ants reacted
Camponotus herculeanus pennsylvanicus	*Trillium grandiflorum* (Michx.) Salisb.
Formica fusca subsericea	*T. grandiflorum*
Formica neogagates var.	*T. grandiflorum*, *Sanguinaria canadensis* L.
Lasius americanus	*S. canadensis*, *Viola cucullata* Ait.
Lasius niger var. *americanus*	*T. grandiflorum*
Myrmica emeryana	*S. canadensis*
Myrmica fracticornis	*T. grandiflorum*
Prenolepis imparis	*Ricinus* species, *V. cucullata*

Observations thus far indicate that carunculate seeds are for the most part of the drop-seed type, *Viola* being an exception. (The mechanical dispersal in *Viola* is accomplished by means of the lengthwise closing of the valves of the capsule, as it opens and dries, ejecting the seeds. Ants may carry them a much greater distance, accomplishing wider dispersal.) Dissemination by ants, in the New England flora, has proven more general than was at first thought, when tests with *Trillium* seeds were made. The interrelation of ants and of carunculate seeds may be even more widespread than is now presumed. In general, ants and carunculate seeds may be interdependent: this, in fact, may be cosmopolitan.

Massachusetts Department of Agriculture,
State House, Boston, Mass.

VIRGINIAN BOTANIZING UNDER RESTRICTIONS

M. L. Fernald

(*Continued from page 413*)

Tiarella Wherryi Lakela in Am. Journ. Bot. xxiv. 344, pl. 1 (1937), including *T. cordifolia*, var. *collina* Wherry, Not. Nat. Acad. Sci. Phil. no. 42: 3 (1940) and *T. cordifolia*, subsp. *collina* (Wherry) Wherry, l. c. 4 (1940). To the counties already recorded (Amelia, Mecklenburg, Henry and James City) add the following. Bedford County: May 7, 1871, *A. H. Curtiss.*

Brunswick County: bluffs of Meherrin River, near Westward Mill, May 4, 1942, *J. B. Lewis*, no. 3410; rich wooded bluffs below Western Bridge, Meherrin River, south of Edgerton, October 12, 1942, *Fernald & Lewis*, no. 14,482. See pp. 379, 380.

I get no satisfaction in trying to separate from *Tiarella Wherryi*, described from Tennessee, southwestern North Carolina and Alabama, the non-stoloniferous plant found from the Blue Ridge eastward to the Coastal Plain. According to Wherry, l. c., "*T. Wherryi* differs in flowering later, in the stems usually bearing one or more leaves, and in the acutish sepals rarely being over 2 mm. long and 0.75 mm. wide", whereas his *T. cordifolia*, var. *collina* (type from Henry County, Virginia) has the "leaves similar to those of var. *austrina* . . . in tending to be longer than wide, and in having the marginal teeth broad with shallow sinus; flowers appearing in spring; flowering stems normally leafless; sepals oblong, obtuse, 2.5–3.5 by 1.5 mm."

Stoloniferous northern *Tiarella cordifolia* has the leaves so variable in outline that it is quite easy to find specimens from Maine, New Hampshire and other northern states and from Quebec, New Brunswick and Ontario with leaves inseparable in outline and toothing from those of southern plants cited as var. *austrina* Lakela or as var. *collina*. As defined by Wherry vars. *austrina* and *collina* have the leaves "tending to be longer than wide", while *T. cordifolia* var. *typica* has, according to him, the leaves "tending to be about as long as wide". As already stated, in New England, where var. *typica* alone is supposed to grow, leaves positively longer than wide are common: 5.3 cm. long, 3.6 cm. wide; 6 cm. long, 4.5 cm. wide; 6.5 cm. long, 5 cm. wide; 8 cm. long, 6 cm. wide; 9 cm. long, 7 cm. wide; 9.5 cm. long, 7 cm. wide; 10 cm. long, 9 cm. wide; 10.3 cm. long, 8.3 cm. wide; 11 cm. long, 7.3 cm. wide; 14 cm. long, 11 cm. wide. When, furthermore, we find that many specimens of the nonstoloniferous var. *collina* "foliis var. *austrina* similis" have leaves nearly or quite as broad as long (Amelia Co.: 8 cm. long by 7.4 cm. wide and 11 cm. long by 9.6 cm. wide; Brunswick Co: 7 cm. long by 6.5 cm. wide, 6.5 cm. long by 7 cm. wide, 7.3 cm. long by 7.5 cm. wide, 10 cm. long by 9.5 cm. wide; Durham County, North Carolina: 9 cm. long by 7.8 cm. wide or 9.5 cm. long by 8.5 cm. wide), it is evident that the difference in proportion is of less significance

than assumed. As for size, the maximum given in the original description of *T. Wherryi* is 14 cm. long and 9 cm. wide; but plenty of New England specimens of *T. cordifolia*, var. *typica* have leaves 10–14 cm. long and 9–11 cm. broad, while in the nonstoloniferous Piedmont *T. cordifolia*, var. *collina* full-grown leaves are essentially the same size; and surely the leaf of *T. Wherryi* was originally described as longer than wide, "folia laminis elongato-ovatis . . . 7–14 cm. longis 6–9 cm. latis" and the type-sheet, as shown by the memorandum on Dr. Lakela's photograph (her plate 1) of it, was originally taken by her to be merely a southern variety of *T. cordifolia*.

As to the bract or bracts on the scape, I am unfortunate in not having before me the large series of Dr. Wherry's material of *T. Wherryi*, which is said to differ from his *T. cordifolia*, var. *collina* in "having the stems usually bearing one or more leaves". If, as appears from the original account of *T. Wherryi*, that species is the nonstoloniferous plant of Tennessee and Alabama, it would seem that the considerable series of such plants from those states which has accumulated in the Gray Herbarium and at the New York Botanical Garden should be *T. Wherryi*. The difficulty is, that in this series, including plants from Tuscaloosa County and other areas cited in the original description "caules floriferi . . . nudi vel 1–3 foliis parvis instructi", only 6 scapes show bracteal leaves (in each case solitary), while 47 scapes are bractless. From the station in Brunswick County, Virginia, of what should be naked-scaped *T. cordifolia*, var. *collina*, one of Mr. Lewis's specimens has a well developed leaf on the scape, while a similar specimen from near Raleigh, North Carolina (*Godfrey*, no. 3424) shows bracted scapes. Incidentally, it is notable that Dr. Lakela's illustration of the type of *T. Wherryi* shows only *naked* scapes.

Coming to the reputed difference between the sepals of *Tiarella cordifolia* (var. *collina*) and *T. Wherryi:* the former with "sepals obtuse, 2.5 to 3.5 by 1 to 1.5 mm.", the latter with "the acutish sepals rarely being over 2 mm. long and 0.75 mm. wide", it seems from the material assembled in the Gray Herbarium that too much stress has been given these points. Material from Tuscaloosa County, Alabama, has blunt sepals 3 mm. long and 1.3 mm. broad, while *T. Wherryi* from Grundy County and from Marion

County, Tennessee, *Svenson*, nos. 7653 and 10,056 respectively, shows the sepals quite obtuse. Desiring a check on my own measurements, I asked, without telling him my results, the very accurate Dr. Robert C. Foster to measure under his binocular some selected specimens. His (and my) measurements give the following results, the specimens all being in late anthesis. *T. Wherryi* from Cumberland County, Tennessee, *C. A. and Una F. Weatherby*, no. 6249, sepals 2.3–2.6 mm. long; from Marion County, Alabama, *E. J. Palmer*, no. 38,997 (as *Heuchera villosa*), sepals 2.3–2.4 mm. long. *T. cordifolia*, var. *typica* from Wilton, New Hampshire, May 11, 1886, *M. A. C. Livermore*, sepals 2–2.2 mm. long; from Charlemont, Massachusetts, May 15, 1915, *Churchill & Woodward*, sepals 2.4–2.6 mm. long; from Becket, Massachusetts, *Fernald*, no. 15,172 (type of forma *parviflora*), sepals 1.8–2.2 mm. long. Since northern stoloniferous *T. cordifolia* may have the sepals down to 1.8 mm. long, while southern nonstoloniferous *T. Wherryi* may have them up to 3 mm. long and 1.3 mm. wide (as well as obtuse), I find myself unable to recognize a specific difference in the sepals.

Dr. Wherry finds that from his Piedmont and Coastal Plain *Tiarella cordifolia*, var. *collina* "The likewise non-stoloniferous *T. wherryi* differs in flowering later", and it is a very striking fact that the type of *T. Wherryi* in young anthesis was collected in Polk County, Tennessee, on June 12. The type-station is a ravine of Hiwassee Beach, between the Unaka Mountains and Beans Mountain, consequently relatively cool and backward. If the non-stoloniferous plants of Tennessee and Alabama are, as seems to be the case, *T. Wherryi*, it becomes important to note the flowering period of other specimens. TENNESSEE: Sevier County (Gatlinburg, not far from the Great Smoky Mountains), April 27, *Sharp*, in flower; Knoxville, Knox County, May 29, *Ruth*, no. 341, fruit and lingering flowers; Cumberland County, May 12, *Weatherby & Weatherby*, no. 6249, fruit and last flowers; Grundy County, alt. 1500 ft., April 27, *Svenson*, no. 7653, flowers; Marion County, May 13, *Svenson*, no. 10,056, flowers; Cheatham County, April 24, *E. J. Palmer*, no. 35,506, flowers. ALABAMA: Tuscaloosa County, April 19, *Harper*, no. 3490, flowers; Marion County, April 21, *E. J. Palmer*, no. 38,997, flowers. When we take the flowering material of the non-

stoloniferous plant from the Blue Ridge east to the Coastal Plain which has come to the Gray Herbarium we get the following score. VIRGINIA: Amelia County, May 2, *J. B. Lewis*, no. 87, flowers; May 21 *Lewis*, no. 89, young fruit and lingering flowers; Brunswick County, May 4, *Lewis*, no. 3410, buds, flowers and young fruit; Henry County, May 6, *Baldwin*, no. 242, flowers. NORTH CAROLINA: Durham County, April 12, *Correll*, no. 5049, flowers; May 4, *Godfrey*, no. 3809, young fruit with lingering flowers; Wake County, April 11, *Godfrey*, no. 3424, flowers; Mecklenburg County, April 26, *C. H. Knowlton*, buds and young flowers. From these facts it can only be surmised that Dr. Wherry's series of later-flowering *T. Wherryi* came from cooler habitats than much of the material collected by others.

Tiarella Wherryi was distinguished by Dr. Lakela by the "fructus carpellis 5–10 mm. longis . . . abrupte rotundatis ad rostellum angustum". Here is a real morphological character which seems to hold, and all the mature fruit of the Piedmont and Coastal Plain plant before me has the short and broad round-tipped valves. Northern and typical *T. cordifolia*, on the other hand, has the fruit often more elongate, 6–12 mm. long, the relatively narrow valves more lance-oblong and gradually tapering to subacuminate at tip. The stoloniferous typical *T. cordifolia*, furthermore, has the lower fruiting pedicels 7–13 mm. long; the lower pedicels of the nonstoloniferous southern series are somewhat shorter (6–10 mm. long). In typical *T. cordifolia* the tip of the filament (after disarticulation of the anther) is relatively blunt; in the nonstoloniferous southern plant the filament is more slenderly tapering at summit. All in all, the short and round-tipped fruit and the slight differences in length of pedicels and in tip of filament mark a southern nonstoloniferous plant, *T. Wherryi*, as distinguished from a more northern stoloniferous one, *T. cordifolia*. Differentiation of the nonstoloniferous plants from east of the Alleghenies from a similar plant, with inseparable technical characters but occurring west of the Alleghenies, seems artificial. It is reminiscent of the artificial separation of like plants as two species, one occurring "east of the Continental Divide", the other west of it, or the too familiar key-characters, "eastern" versus "western".

*Philadelphus inodorus L. Caroline County: steep wooded bluff by Rappahannock River, northeast of Return, *Fernald, Long & Fogg,* no. 14,168, spread from cultivation. See p. 358.

Hamamelis virginiana L., var. parvifolia Nutt. Local range extended into Southampton County: dry woods near Johnson's Millpond north of Sedley, nos. 14,336 and 14,337, strongly contrasting with typical *H. virginiana* growing with it.

*× Pyrus Lecontei Rehder (*P. communis* L. × *pyrifolia* (Burm.) Nakai). Princess Anne County: large shrubs persisting in clearing about old house, Cedar Island, no. 12,361. Essex County: border of dry woods northeast of Loretto, *Fernald, Long & Abbe,* no. 14,169. Southampton County: border of woods 1 mile south of Branchville, no. 10,277.—Identifications kindly supplied by Professor Rehder, who informs me that this hybrid was extensively introduced by Le Conte.

*Malus angustifolia (Ait.) Michx., var. puberula Rehder. Surry County: dry oak and pine woods southwest of Spring Grove, *Fernald, Long & Abbe,* no. 14,170; dry oak and pine woods southwest of Savedge, *Fernald, Long & Abbe,* no. 14,171, tree 25 feet high, with trunk 6 inches in diameter. Identifications kindly supplied by Professor Rehder, who states that the only material he had previously seen was from Louisiana and Mississippi.

Although I here enter *Malus angustifolia* as a species of *Malus* in deference to Professor Rehder who made the identifications, the so called generic distinctions between the subgenera or sections of *Pyrus* sensu DeCandolle, Endlicher, Bentham & Hooker, Focke, Engler & Prantl, Gray, Bailey and others are no different now than they were when those students of worldwide relationships treated them as all belonging in the single genus *Pyrus.* In Rehder's Manual, ed. 2, the key to genera gives these distinctions:

Styles connate at base: fr. usually apple-shaped, without or with few grit-cells	26. *Malus.*
Styles free: fr. usually pear-shaped, its flesh with numerous grit-cells	30. *Pyrus.*

Much hangs on the shape of an apple, whether the depressed-globose of the old fashioned Russet or the elongate ovoid of a Gilliflower. Similarly, although the obovoid form of most of our commonly cultivated pears is familiar, one has to look no farther than Hedrick's Pears of New York to see beautiful life-sized plates of ovoid to globose pears: globose-ovoid, suggesting a

Hubbardston apple, in *Pyrus serotina;* globose as a cherry in *P. betulaefolia;* depressed-globose, like a conventional apple, in "Gansel Seckel" and even more depressed in "Idaho". In fact, of the Pears treated in Rehder's Manual ("fr. usually pear-shaped") 13 out of the 15 species have the fruit described as "globose" "globular" "subglobose" or "ovoid"; while such a species as *Malus Halliana* is described in Rehder's key as having "fr. pyriform". The terms "apple-shaped" and "pear-shaped" thus become a bit vague. Since, furthermore, two sections of *Malus*, as accepted by Rehder, have grit-cells, we get down to styles connate at base in *Malus*, free in *Pyrus*, and another character: "lvs. . . folded or convolute in bud" in *Malus*, "involute in bud" in *Pyrus*. These, if absolutely constant, are much sounder characters than shape of fruit. I have not sufficient knowledge of the many species to be sure whether these characters are absolute. Many wise taxonomists of the past and the present have doubted their value as full generic differences, when there is so much variation in other characters. It is often said that apples and pears do not hybridize; that that is a sure test. Therefore, since *Sorbus* and *Aronia* do hybridize, keep them apart as genera and set up a new genus, × *Sorbaronia* Rehder, for their hybrid offspring, just as the genus × *Sorbopyrus* has been set up for the hybrid of *Pyrus communis* and *Sorbus aria*. Neither the failure of some groups to cross nor the occurrence of crosses between ordinarily quite distinct genera is the final test. So many proven cases of incompatability within genera have been noted that one can hardly argue that incompatibility necessarily demonstrates distinctness of genera; and when such utterly unrelated genera as *Cyperus* and *Rhynchospora* have sometimes crossed, producing × *Cyperus Weatherbianus* Fern., we do not merge the two genera.

If *Pyrus*, *Malus*, *Sorbus* and *Aronia* are distinct genera are not *Azalea* and *Therorhodion* equally separable from *Rhododendron; Polycodium* and *Cyanococcus* from *Vaccinium; Amygdalus* and *Cerasus* from *Prunus*? These subgenera have quite as many and as sound morphological characters. I am inclined to follow DeCandolle, Endlicher, Bentham & Hooker, Focke, Engler & Prantl, Gray and Bailey until much stronger cases are presented for the generic segregation of Pyrus in its inclusive sense. Mor-

phologically its elements are no more discordant than those of *Pinus* and *Quercus*.

*Psoralea psoralioides (Walt.) Cory, var. eglandulosa (Ell.) F. L. Freeman in Rhodora, xxxix. 426 (1937). Dinwiddie County: low open pineland, thickets and clearings just east of McKenney, no. 14,346. First from northeast of western South Carolina. See p. 366.

*Tephrosia virginiana (L.) Pers., var. glabra Nutt. ex Torr. & Gray, Fl. N. Am. i. 296 (1838). Hanover County: dry pine woods south of Ashland, no. 7460. Isle of Wight County: clearing in damp sandy pine barrens, south of Zuni, no. 14,345. Southampton County: dry sand of pine barrens about 7 miles south of Franklin, nos. 7459 and 7461. See p. 369.

Tephrosia virginiana, var. *glabra*, originally described from Georgia, occurs also in pine barrens or on sand-ridges of South Carolina (Clarendon County, *Godfrey & Tryon*, no. 1021) and in New Jersey. Whereas typical and wide-ranging *T. virginiana* has the internodes and leaf-rachises more or less villous, the villi either few or very numerous, the lower surfaces of the leaflets pilose to sericeous and the legume copiously long-villous, the internodes and rachises of var. *glabra* are at most closely short-hispid and often glabrate, the leaflets sparsely strigose to glabrous beneath and the legumes closely silky-strigose, not copiously villous. In eastern Virginia it seems to be the pine-barren extreme.

Recently some students have indicated the occurrence in the Atlantic States (New England and New York to South Carolina) of var. *holosericea* (Nutt.) Torr. & Gray, l. c., based on *T. holosericea* Nutt. in Journ. Acad. Sci. Phila. vii. 105 (1834) and I find many specimens in the Gray Herbarium from these states marked over as var. *holosericea*. So far as I can see they are nearly if not quite typical *T. virginiana*, the individuals with a few pin-point trichomes to be found on the upper surfaces of some leaflets. Nuttall's plant was a more definite variation than this: "whole plant sericeous, scarcely excepting the upper surface of the leaves. *Hab.* In the plains of Arkansas."—*Nuttall.* Torrey & Gray correctly defined it: "stem and raceme densely villous; leaflets very silky-pubescent on both sides". If we keep to the original accounts and restrict var. *holosericea* to the plants with "leaflets very silky-pubescent on both sides" (*i. e.* above as well as be-

neath) that variety assumes an inland range, from Michigan and Wisconsin to Texas, and we do not have to oversort the plants of the Atlantic States.

*Glycyrrhiza lepidota Nutt., var. glutinosa (Nutt.) S. Wats. Brunswick County: fallow field back of old Chamblis Place, Seward Forest, near Triplett, no. 14,483. A large patch, spreading extensively by long subterranean rootstocks, doubtless originally cultivated. This is the western extreme with glutinous foliage, the stems covered with stout glands and viscid setae. See p. 378.

Vicia caroliniana Walt. Local range extended northward to Dinwiddie County: low open pineland, thickets and clearings just east of McKenney, no. 14,350. See p. 365.

Polygala Senega L., var. latifolia Torr. & Gray. Brunswick County: oak-hickory woods back of old Chamblis Place, Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,484; the first from the southeastern section of the state. See p. 378.

P. sanguinea L. To the few and scattered stations in southeastern Virginia add a second one in Dinwiddie County: low open pineland, thickets and clearings just east of McKenney, no. 14,355. See p. 366.

*Euphorbia corollata L., var. paniculata (Ell.) Boiss. Henrico County: open thicket, South Richmond, no. 12,711. Extension north from North Carolina.

Acer floridanum (Chapm.) Pax. Brunswick County: very abundant in rich woods near Western Bridge, Meherrin River, south of Edgerton, *Fernald & Lewis*, no. 14,487. See p. 379.

Aesculus neglecta Lindl., var. pubescens Sargent. Greensville County: in great abundance in rich woods along Meherrin River, below Emporia, *Fernald & Lewis*, no. 14,537. See p. 383.

Previously misidentified from meagre shrubs farther down and to the north of the river as *Ae. discolor* Pursh, which should be dropped from the Virginia list.

Hypericum denticulatum Walt., var. ovalifolium (Britt.) Blake. To the few and remote stations add one in Southampton County: moist sandy and peaty shore of Whitefield's Millpond, southwest of Corinth, no. 14,366. See p. 373.

H. setosum L. Range extended inland to Brunswick County: wet level opening in flat woods, 1½ miles southeast of Triplett, August 18, 1942, and swampy old field south of Seward Forest, Triplett, August 5, 1943, *J. B. Lewis*. See pp. 374–376.

Viola cucullata Ait. Very local on or near the Coastal Plain southward. The following are our only stations. King

AND QUEEN COUNTY: magnolia swamp about 2 miles northeast of St. Stephen's Church, *Fernald, Long & Abbe,* no. 14,203. SURRY COUNTY: low woods, Cypress Swamp, near Sexton, *Fernald, Long & Abbe,* no. 14,204. See p. 358.

V. LANCEOLATA L. To the few stations inland from the coast add one in ISLE OF WIGHT COUNTY: muddy and swaley shore, Darden's Pond, southeast of Collosse, no. 14,367.

V. LANCEOLATA, var. VITTATA (Greene) Weath. & Grisc. To the few recorded stations add one in SOUTHAMPTON COUNTY: moist sandy and peaty shore of Whitefield's Millpond, southwest of Corinth, no. 14,368. See p. 373.

V. STRIATA Ait. A second Coastal Plain station, this one in GREENSVILLE COUNTY: rich woods along Meherrin River, below Emporia, *Fernald & Lewis,* no. 14,538. See p. 383.

RHEXIA VENTRICOSA Fern. & Griscom. Range extended inland to DINWIDDIE COUNTY: ditch bordering low open pineland just east of McKenney, no. 14,369. See p. 366.

*OENOTHERA TETRAGONA Roth, var. RIPARIA (Nutt.) Munz. DINWIDDIE COUNTY: low open pineland, thickets and clearings just east of McKenney, no. 14,370. First from north of Wilmington, North Carolina. See p. 366.

PROSERPINACA INTERMEDIA Mackenz. To the recorded Virginia station (near Lee Hall) add one in SOUTHAMPTON COUNTY: moist sandy and peaty shore of Whitefield's Millpond, southwest of Corinth, no. 14,373. See p. 373.

*ERYNGIUM PROSTRATUM Nutt. SOUTHAMPTON COUNTY: moist sandy and peaty shore of Whitefield's Millpond, southwest of Corinth, no. 14,375. First from north of South Carolina. Identification tentative, the young fruit showing characters not surely matched in *E. prostratum.* Mature material is needed. See p. 373.

ZIZIA TRIFOLIATA (Michx.) Fern. (*Z. Bebbii* (C. & R.) Britt.). BRUNSWICK COUNTY: oak-hickory-beach woods back of old Chamblis Place, Seward Forest, near Triplett, *Fernald & Lewis,* no. 14,489. First from east of the mountains. See p. 378.

*SIUM FLORIDANUM Small. SOUTHAMPTON COUNTY: wooded bottomland of Blackwater River, southeast of Ivor, no. 13,710, the arching or lopping stems left stranded after submergence and proliferating, the proliferous shoots producing simple leaves; sandy alluvial bottomland of Three Creek, Adams Grove, no. 14,376. GREENSVILLE COUNTY: wooded bottomland of Fontaine Creek, southeast of Taylor's Millpond, plants up to 7 feet high, no. 11,384, distrib. as *S. suave* Walt. See p. 368.

Sium floridanum, not recognized when Blake made the comparison, may be *S. suave* Walt. Whether it is a distinct species or a southern variety of the transcontinental northern as well as

southern plant which now passes as *S. suave* (*S. cicutaefolium*) is not wholly clear. The common northern and wide-ranging plant, which we call *S. suave*, has (except in the submersed forma *Carsonii* (Durand) Fassett and in the wholly atypical estuarine forma *fasciculatum* Fassett) the erect or ascending stem strongly corrugated; *S. floridanum* has the usually slender and more flexuous stem terete, in drying only slightly ribbed. In *S. suave* the stem branches near the summit, usually above the middle; the corrugate-angulate branches are strongly ascending; and the principal cauline leaves (below the branching) are strongly ascending, with 5–17 firm leaflets 4–15 cm. long. In *S. floridanum* the stem branches usually well below the middle, the terete branches are spreading-ascending to nearly horizontal; and the larger divergent to horizontally spreading leaves have 3–11 membranaceous leaflets 2–9 cm. long. In *S. suave* the largest (leading) umbel of each plant is 4–11 cm. broad, with angulate peduncle and 10–25 definitely angled (when dry) rays; in *S. floridanum* the more open fully developed umbels are 1–7 cm. broad, on filiform peduncles and with 7–15 filiform rays. In *S. suave* the angled pedicels of the umbellules are stiffly ascending; in *S. floridanum* the filiform pedicels are more curving or arching and prolonged. In flower and fruit the two are similar, but the petals of *S. floridanum* are narrower and the filaments and styles longer than in *S. suave*. As stated, when we have fuller material *S. floridanum* may prove to be a geographic variety, rather than a true species. The contrasts are here stated, that others may watch for this southern plant. As stated also, Walter could have had either as the basis of his *S. suave*.

Sium suave, forma *Carsonii*, the submersed and weak state of the wide-ranging transcontinental plant, has filmy foliage and small mostly infertile umbels. It might seem to some to include *S. floridanum;* but it is clearly demonstrated to be merely an ecological phase of *S. suave* (*cicutaefolium*). Its ascending petioles, its angulate-corrugated umbel-rays (when dry), its short and stiff pedicels, broadly rounded petals, short filaments and short style clearly show it to be *S. suave*.

Pyrola rotundifolia L., var. americana (Sweet) Fern. Brunswick County: wooded bluff along Rattlesnake Creek, west of Triplett, *Fernald & Lewis*, no. 14,538, healthy colony,

never flowering. Station at remarkably low altitude for southern Virginia. See p. 377.

*VACCINIUM STAMINEUM L., var. INTERIUS (Ashe) Palmer & Steyermark (*Polycodium interius* Ashe). HANOVER COUNTY: dry sterile woods near Polegreen, no. 13,417 (fruit blue with a bloom). JAMES CITY COUNTY: woods north of Jamestown Road, about 1 mile from Willamsburg, *J. T. Baldwin, Jr.* no. 206.

Var. *interius*, as its name implies, is a characteristic shrub of the Interior. The material (except for these sheets from eastern Virginia) in the Gray Herbarium is from West Virginia, Kentucky, Missouri, Arkansas, northern Louisiana, Kansas and Oklahoma. It is of course questionable if it is a true geographic variety, the characters ordinarily used in this series (genus *Polycodium*) being very plastic or fickle. In eastern Virginia we get three of these: typical *V. stamineum* with the young branchlets pilose, the mature leaves somewhat so on the lower surface or the lateral veins, a very common plant; var. *interius* with young branchlets pilose but the leaves glabrous except along the midrib beneath; and the common var. *neglectum* (Small) Deam, with young twigs and leaves both quite glabrous. *V. caesium* Greene, a low shrub (commonly only 2–5 dm. high) of sandhills and pine barrens closely approaches the state in North Carolina, and may be watched for with confidence. Its small and broad leaves (1.5–5 cm. long) and the very large and rounded bracts (1–2 cm. broad) greatly exceeding the subtended pedicels well mark it. The group is by no means properly understood, and the varieties (species of Greene, Ashe and Small) may prove to be minor forms without good geographic ranges.

*V. VIRGATUM Ait. SOUTHAMPTON COUNTY: dry white sand in oak and pine woods and clearings bordering Assamoosick Swamp, south of Sebrell, no. 10,374, as *V. Elliottii* Chapm.—shrubs 2 m. high. Originally, on account of its stature, placed in *V. Elliottii* but differing clearly from that species, which has the leaves lustrous and full green on both surfaces, membranaceous and without reddish glands and gradually rounded to base, by its firmer leaves subcuneate at base, reddish glandular hairs mixed with the pilosity of the lower surface, and the very stiff and compact branching. It fairly matches more southern material identified by Gray and later by Camp as true southern *V. virgatum*.

*V. VACILLANS Torr., var. CRINITUM Fern. SURRY COUNTY: dry thicket 1 mile north of Surry Courthouse, no. 10,773, narrow-leaved extreme.

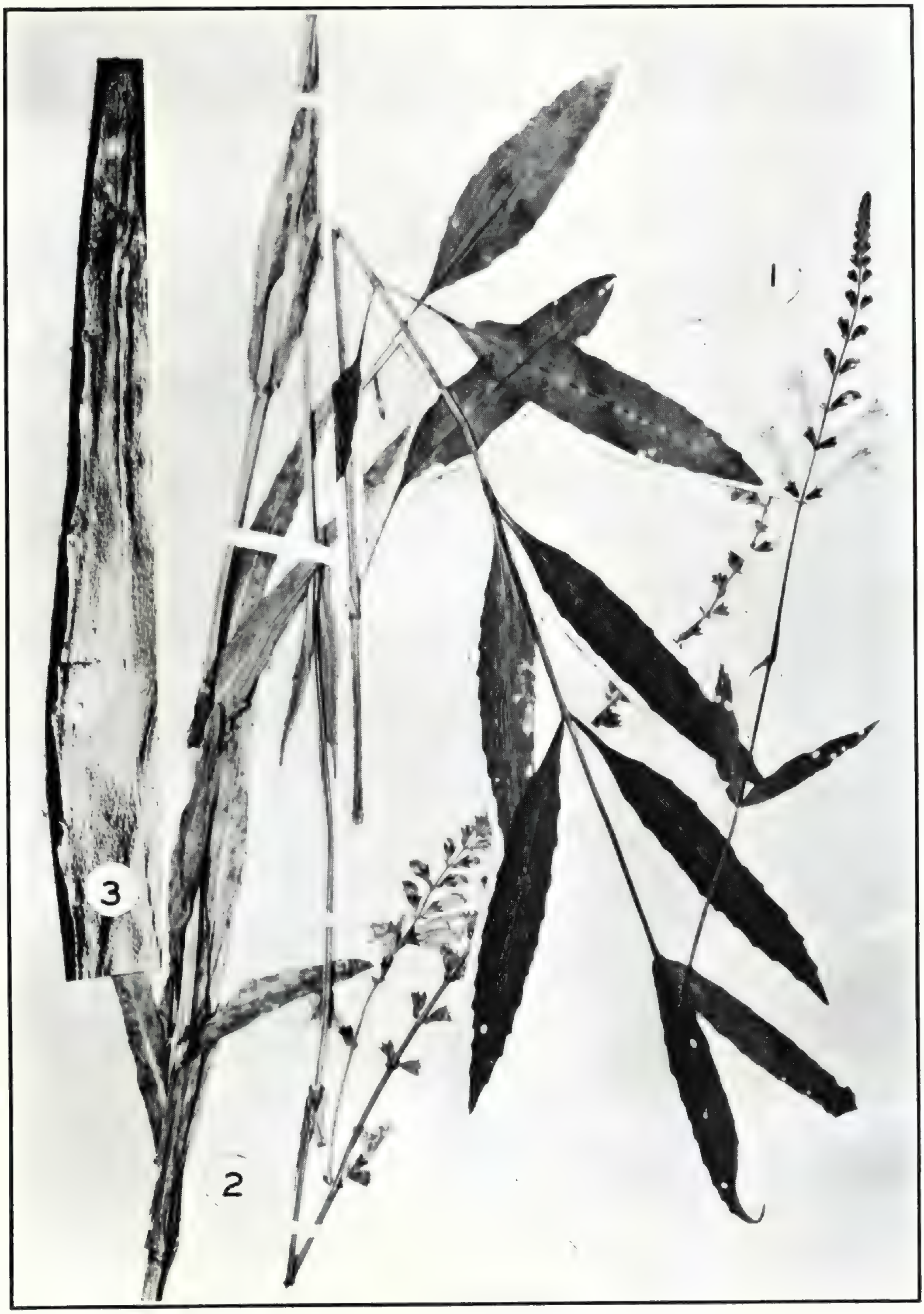


Photo. B. G. Schubert.

PHYSOSTEGIA DENTICULATA: FIG. 1, plant, × $\frac{2}{5}$
P. INTERMEDIA: FIG. 2, plant, × $\frac{1}{2}$; FIG. 3, leaf-margin, × 2

Photo. B. G. Schubert.

PRASIUM? PURPUREUM Walt.: FIG. 1, leaf, × 1, from tracing by *S. F. Blake*
PHYSOSTEGIA ANGUSTIFOLIA: FIGS. 2–4, *Drummond*, no. 251, × 5/9; FIG. 5, leaf of 251, × 2; FIG. 6, TYPE of species, × 5/12; FIG. 7, portion of leaf, × 2, from TYPE

Camp has renamed *Vaccinium vacillans* as originally and beautifully described by Torrey, Fl. N. Y. **1:** 444 (1843). In its place he publishes the very appropriate *V. Torreyanum* Camp in Am. Midl. Nat. xxiii. 177 (1940) = "*Vaccinium vacillans* Torrey, Fl. N. Y. **1:** 444. 1843 (non exemp. in Mus. Brit.)" and to *V. pallidum* Ait. he refers "*Vaccinium vacillans* Kalm, apud Torrey, Fl. N. Y. **1:** 444. 1843 (typ. in Mus. Brit. est)."

Torrey, unfortunately, gave to the familiar shrub so clearly described from New York state an old herbarium-name, *V. vacillans* "*Kalm, mss. in Herb. Banks*". The latter is worse than a *nomen nudum.* It had never been published even as a *nomen* and, surely, Torrey had not seen it in Banks's herbarium, since he did not go abroad. At best he had hearsay knowledge of it. I am, therefore, unable to see that a mere herbarium-name, given by Kalm to something which Torrey had not seen and which, according to Camp's note, he wholly misunderstood, takes precedence over the material from "the vicinity of New York" which Torrey so fully and accurately described. I retain the name *V. vacillans* as of Torrey. Had the name *V. vacillans* been accompanied by a description of Kalm's material or had it been previously published, it would stand for that element. Since Torrey, who first took up the name, described only the New York element, which Kalm did not have, the name is typified by Torrey's material, the only material described.

STYRAX AMERICANA Lam. To the relatively few stations in Virginia add one in SUSSEX COUNTY: upper border of sandy beach, Airfield Millpond, southwest of Wakefield, no. 14,383. See p. 372.

*CYNOCTONUM SESSILIFOLIUM (Walt.) J. F. Gmel. BRUNSWICK COUNTY: wet level opening in woods, 1½ miles southeast of Triplett, August 24, 1942, *J. B. Lewis.* See pp. 374 and 376.

POLYPREMUM PROCUMBENS L. It is so often stated that *Polypremum* is an annual ("much branched small annual"—Gray, Man.; "annual diffuse herb"—Small, Man.) that the correct description of Gray, Synopt. Fl., should be emphasized: "much branched from an annual (sometimes almost ligneous) root." In sandy clearings of Brunswick County the mature plants, late in the autumn, send out vigorous and crowded new basal offshoots, much as in *Lechea* (see *Fernald & Lewis*, no. 14,492).

AMSONIA TABERNAEMONTANA Walt. Local range extended to BRUNSWICK COUNTY: rich wooded slope below Western Bridge,

Meherrin River, south of Edgerton, *Fernald & Lewis*, no. 14,491. See p. 380.

*ASCLEPIAS LANCEOLATA Walt., var. PAUPERCULA (Michx.) Fern., forma **flaviflora,** floribus flavis. NORFOLK COUNTY: fresh reed-marsh and swale along Northwest River near Northwest, June 30, 1942, *Fernald & Long*, no. 14,390—a single plant associated with the rather abundant typical var. *paupercula* in which the hoods are deep orange to scarlet. TYPE in Herb. Gray. See p. 368.

*ACERATES VIRIDIFLORA (Raf.) Eaton, var. LANCEOLATA (Ives) Gray. PRINCE GEORGE COUNTY: argillaceous field north of Fort Hell, south of Petersburg, very scarce, no. 12,778. SUSSEX COUNTY: open thickets and clearings near Nottoway River at Readjuster Bridge, south of Peanut, no. 12,438.

Acerates viridiflora is excessively variable in foliage but all the material before me from southern New England and southern New York southward to the Carolinas, with the exception of five numbers from eastern Pennsylvania (Phil. Acad.) and the two numbers above cited, has the blunt or abruptly short-tipped leaves elliptic, oblong, oval or oblong-obovate and is, I take it, true *A. viridiflora*. Rafinesque's original description called for a "lanceolated, obtuse" leaf, "leaves lanceolated, obtuse, hirsute, umbells axillar, bending down, corniculas, without appendices. I have found it in several parts of Maryland and Pennsylvania, mostly in fields." In view of the oblong, elliptic or oblong-obovate outline of the obtuse leaves in the plant of Pennsylvania and Maryland, it is assumed that Rafinesque's "lanceolated" was used with poetic license.

In the representation in the Gray Herbarium there is no material of this obtuse-leaved plant from the north-central states. It occurs in North Carolina (Small implies Florida), Louisiana, Texas and New Mexico, northward in the Mississippi drainage to Kentucky and Kansas. From southern Ontario to Manitoba and Wyoming the usual plant has lanceolate to narrowly ovate leaves tapering from near the base to acuminate or prolonged acute tips. This is var. *lanceolata* (Ives) Gray, occurring from southern Ontario, Manitoba and Wyoming southward to Louisiana, Texas and New Mexico, in the South mingling with the obtuse-leaved plant. I am quite unable to separate the two numbers from Virginia and some from southeastern Pennsylvania from characteristic var. *lanceolata* of the Interior. In the East

they look like mere leaf-variations of one plant. In view of the very different broad ranges of the two, however, I am making this note, especially with the hope that the plants will be carefully checked elsewhere in the East.

PHLOX NIVALIS Lodd. (*P. Hentzii* Nutt.) An extensive station in GREENSVILLE COUNTY: dry sandy woods along Fontaine Creek, Round Hill Church, *Fernald & Lewis*, no. 14,543. See p. 383.

P. CAROLINA L., var. TRIFLORA (Michx.) Wherry. Another station in DINWIDDIE COUNTY: low open pineland, thickets and clearings just east of McKenney, no 14,393. See p. 365.

NEMOPHILA MICROCALYX (Nutt.) Fisch. & Mey. This vernal annual, characteristic along the James, is also in GREENSVILLE COUNTY: rich woods along Meherrin River, below Emporia, *Fernald & Lewis*, no. 14,542, growing with the abundant *Phacelia dubia* and very luxuriant (up to 4.5 dm. high). See p. 383.

HYDROLEA QUADRIVALVIS Walt. Range extended inland to BRUNSWICK COUNTY: swampy pond-hole in woods, Rattlesnake Creek, west of Triplett, *Fernald & Lewis*, no. 14,493. See p. 377.

MYOSOTIS VERNA Nutt. Local range extended. JAMES CITY COUNTY: rich woods and slopes by James River, Grove Landing, southeast of Grove, FERNALD, LONG & ABBE, no. 14,227. SUSSEX COUNTY: fallow field along Nottoway River at Readjuster Bridge, south of Peanut, *Fernald, Long & Abbe*, no. 14,228.

SCUTELLARIA SERRATA Andr. BRUNSWICK COUNTY: rich wooded slope near Western Bridge, Meherrin River, south of Edgerton, *Fernald & Lewis*, no. 14,494. See p. 380. Epling, in his American Species of Scutellaria, Univ. Cal. Pub. Bot. xx. no. 1, 85 (1942) cites no Virginia specimens from the southern counties east of the Blue Ridge.

*PHYSOSTEGIA **aboriginorum,** sp. nov. (TAB. 783), planta robusta 10.5–12 dm. alta basi valde surculoso; caule glabro ad basin 0.8–1 cm. diametro; foliis firmis sessilibus vel imis late subpetiolatis oblongis obtusis vel subacutis undulato-sinuatis, primariis 8–11 cm. longis 1.7–2.5 cm. latis; inflorescentia paniculata, ramibus lateralibus prolongatis arcuato-adscendentibus; spicis subdensis 0.4–2 dm. longis, calycibus fructiferis imbricatis, rhachi puberula; calycibus breviter campanulatis puberulis, tubo maturo 5–6 mm. longo, dentibus deltoideis; corollis purpureis 2–2.5 cm. longis fauce ampliato 8–10 mm. diametro; filamentis ad apicem villosis.—Norfolk County, VIRGINIA: swale at margin of Indian Creek (whence the specific name), northeast of Northwest, June 30, 1942, *Fernald & Long*, no. 14,397 (TYPE in Herb. Gray.; ISOTYPE in Herb. Phil. Acad.). See p. 368.

Physostegia aboriginorum differs strikingly from the more fre-

quent species of southeastern Virginia (of the Blackwater and the Nottoway drainage-systems) in its broader-oblong, merely undulate-margined, firm sessile leaves, the lower ones narrowed merely to dilated bases, the upper ones but slightly reduced in size; the panicled spikes densely flowered, with imbricated pairs of fruiting calices; the corolla more ampliate; the filaments copiously pilose to summit. *P. denticulata* (Ait.) Britton (our PLATE 784, FIG. 1), common in the alluvium of the Nottoway or the Blackwater and their tributaries in Southampton, Isle of Wight and Nansemond Counties, has the leaves thin and membranaceous, the lower 4 to 6 pairs oblanceolate or oblong and on long slender petioles, the middle and upper ones sessile and long-attenuate at tip, the uppermost very small. Its usually solitary, slenderly elongate spike is very interrupted, the pairs of flowers and fruiting calices remote; the corolla more slender, the filaments glabrous or only sparsely pilose at tip.

From *Physostegia leptophylla* Small the Norfolk County plant differs in its much larger leaves in more scattered and more sessile pairs, with merely undulate margins, and in its more slender corolla, *P. leptophylla* having the many (up to 16) pairs of more prominently dentate leaves mostly narrowed to base and the greatly distended corolla with throat 1.5 cm. broad at summit. From *P. veroniciformis* Small *P. aboriginorum* differs in much greater size, the leaves not fiddle-shaped, the calyx-lobes short and deltoid, instead of elongate and lanceolate, the corolla larger, and the long, as well as the short, filaments hairy.

This segregation of species of the Northwest River and its tributary, Great Dismal Swamp, and the North Landing River drainage, with small tributaries interlocking with those of the Northwest River, both emptying into the head of Currituck Sound, is very real. The Blackwater and Nottoway merge at the State Line to form the Chowan, which, a few miles farther south receives the Meherrin and then empties into Albemarle Sound. On the bottomlands or wooded slopes of the Blackwater, Nottoway or Meherrin on the Coastal Plain of Virginia hundreds of species occur which we do not know from the bottoms, swamps and marshes of the more eastern drainage systems. Conversely the Northwest and North Landing drainage (or that of Back Bay slightly to the east) have scores (many

more yet to be discovered) of plants which we do not know from the Blackwater, the Nottoway or the Meherrin drainage (*Pinus serotina*, *Limnobium Spongia*, *Arundinaria gigantea*, *Andropogon virginicus* var. *glaucopsis*, *Scleria flaccida*, *Cladium jamaicense*, *Wisteria frutescens*, *Ilex vomitoria*, *I. coriacea*, *Stewartia Malachodendron*, *Ludwigia pilosa*, *L. alata*, *Asclepias lanceolata* var. *paupercula*, *Lobelia elongata*, *Eupatorium recurvans*, *E. cuneifolium*, *Aster Elliottii*, etc.). *Physostegia aboriginorum* is the latest addition to this series.

I am using the name *Physostegia denticulata* in its traditional sense. Originally published as *Dracocephalum denticulatum* by Aiton, Hort. Kew. ii. 317 (1789) from Carolina material, its diagnosis was good, though very brief: "D. floribus spicatis remotis, foliis obovato-lanceolatis superne denticulatis". Such a plant abounds, as stated, on the Coastal Plain bottomlands of the Blackwater and the Nottoway, thence south to Florida, represented in the Gray Herbarium by material from five counties of North Carolina: Hertford, on the Chowan River, and Perquimans, draining into Albemarle Sound; thence south to the region of Wilmington, and from Georgetown County, South Carolina. The general geographic source of Aiton's material is unequivocal.

In RHODORA, xvii. 134 (1915) Blake, publishing the combination *Physostegia purpurea* (Walt.) Blake, based on *Prasium? purpureum* Walt. Fl. Carol. 166 (1788), identified it with *P. denticulatum*. Walter's diagnosis was as follows: "foliis oppositis sessilibus lanceolatis dentatis, floribus purpureis, spicis distichis terminalibus"; and the very sketchy sketch (our PLATE 785, FIG. 1) made by Blake of the type of *Prasium? purpureum* is difficult to match in any material usually placed in *Physostegia denticulata*. Blake's description (mss. in Gray Herb.) of the specimen says "leaves . . . 3 mm. wide . . . Corolla would be just 2 cm. long if straightened out . . . It agrees very well with Drummond 251, *e. g.* in Brit. Mus." Now it so happens that Drummond's no. 251 from New Orleans (our PLATE 785, FIGS. 2–5) has elongate-linear leaves very strongly suggesting Blake's sketch of the much crumpled Walter type, but it has finely sharp-serrate margins (FIG. 5) and is a quite characteristic specimen of a wide-ranging species (our PLATE 785,

FIGS. 6 and 7) which occurs from Tennessee to Illinois and Arkansas, south to Mississippi, Louisiana and Texas, the plants variously misidentified as *P. denticulata*, *P. virginiana* (L.) Benth. ("very slender form") and *P. speciosa* Sweet. Furthermore, a habitally quite similar species, *P. intermedia* (Nutt.) Engelm. & Gray (our PLATE 784, FIGS. 2 and 3), with slender and interrupted spike and with leaves narrowly lanceolate to linear but with flowers relatively small, extends eastward into Kentucky and Alabama. This small-flowered species has the leaves dentate, as described by Walter for *Prasium? purpureum*, not acutely serrate as in *Drummond*, no. 251; but, so far as we know, neither of these sessile- and narrow-leaved species is east of the mountains. With no such plant as indicated by Blake's sketch (PLATE 785, FIG. 1) now known in Walter's territory, it is unsafe to assert with confidence just what his *Prasium? purpureum* is. Until Walter's type can be rechecked with Drummond's no. 251 (with linear, sharp-toothed leaves and slender, interrupted spikes) clearly in mind there must remain some doubt regarding its identity with *Physostegia denticulata*. Until his type can be reexamined and closely compared with a series including all known species of the Carolinas, as well as *Drummond*, no. 251 and *Physostegia intermedia*, it is safest to let the name rest, as it did until Blake took it up, as still of doubtful significance.

I am, therefore, at the risk of possibly publishing a species already inadequately described, proposing

P. **angustifolia,** sp. nov. (TAB. 785, FIG. 2–7), planta erecta caule glabro 3–10 dm. alto; foliis rigidis griseis vel pallidis linearibus vel anguste lanceolatis sessilibus numerosis (16–22 jugis), imis obtusis vel subacutis, mediis attenuatis valde angusteque adpresso-serratis 4–10 cm. longis 3–10 mm. latis, foliis supernis valde reductis; spicis solitariis vel paniculatis elongatis ad 3.5 dm. longis floribus distantibus, rhachi puberulo; calycibus campanulatis 6–10 mm. longis pruinoso-puberulis glandulosisque dentibus deltoideis acuminatis; corollis purpureis vel albescentibus 2.5–3 cm. longis.—TENNESSEE: thickets along fence, Lavergne, Rutherford County, August 12, 1922, *Svenson*, no. 242. MISSISSIPPI: roadside bank near Egypt, Chickasaw County, May 18, 1933, *C. A. & Una F. Weatherby*, no. 6318, TYPE in Herb. Gray. ILLINOIS: Arlington Heights, Cook County, August 25, 1934, *Benke*, no. 5680; prairie, South Chicago, September 15, 1910, *Lansing*, no. 2803; Champaign, September 11, 1909, *Pease*, no. 12,403; LaSalle County, *Huett;* Sugar Creek Prairie, Richland

County, September 5, 1914, *Robert Ridgway*. ARKANSAS: moist roadside and ditch-bank, Fayetteville, June 13, 1938, *Fassett & Nielsen*, no. 19,829; low ground, northwestern Arkansas, June, *F. L. Harvey*, no. 116. LOUISIANA: Covington, May and June, *Hale;* New Orleans, 1832, *Drummond*, no. 251. TEXAS: de Bejar à Austin, Avril, 1828, *Berlandier*, no. 466; Amelia, Jefferson County, October 5, 1934, *Cory*, no. 11,108; Kerrville, Kerr County, June 25, 1894, *Heller*, no. 1906; 8 miles south of Bandera, Bandera County, June 5, 1933, *Cory*, no. 6607.

Most of the material (including many specimens not cited) has been distributed as *Physostegia virginiana* (L.) Benth., but that, as shown by a beautiful photograph of the type before me, is the common northeastern plant with relatively thin, lanceolate, often copiously and saliently serrate leaves mostly 1–2.5 cm. wide, the uppermost much reduced, the flowers in relatively short and crowded spikes (in fruit with imbricated calices and rarely 2 dm. long), the corolla 2–3 (in the type 2.4) cm. long. It has also been called *P. virginiana* var. *speciosa* (Sweet) Gray, but that is a variation of *P. virginiana* with broader and often more prominently serrate leaves, the larger blades 2–4 cm. wide and less reduced in size toward the summit of the stem. Sweet's original plate shows the corolla 2.5 cm. long.

Relatively small plants of *Physostegia virginiana* from the lower Susquehanna in southeastern Pennsylvania have sometimes been called *P. denticulata* because their leaves have the marginal teeth few and short. Similar forms, with low stature, small leaves and reduction of teeth, abound about Lake Champlain and in the vicinity of Montreal on the St. Lawrence. Others from the same regions and of similar proportions have well developed sharp teeth. They seem to be a reduced state of *P. virginiana*, somewhat atypical but without constant enough characters to merit specific recognition. The designation of the individuals of this small extreme of tidal shores of the St. Lawrence as a distinct species, *P. granulosa* Fassett in RHODORA, xli. 377 (1939), our PLATE 786, FIGS. 1 and 2, because it is stoloniferous and because its calyx is more glandular-puberulent than in some *P. virginiana*, overlooks the fact that carefully collected *P. virginiana* has stolons. Witness specimens of *Fernald & Long*, no. 14,465 from Hampden, Maine, of *Fassett*, no. 14,341 (our PLATE 786, FIGS. 3 and 4) from Bingham, Maine (toward 50 miles up-

river beyond the limit of tide and with leaves as small as and with fewer teeth than in isotypes of *P. granulosa*—in no. 14,341 some leaves with as few as 2–5 low teeth on each side, the type of *P. granulosa* described as with 4–8 but the isotypes in the Gray Herbarium showing 5–9 pairs of teeth), of the Faxons and others from Lake Champlain (PLATE 786, FIG. 5), of Eames from Trumbull, Connecticut, or of any other botanist who takes pains carefully to collect the stolons. The small extreme with small leaves having few and low teeth and the pubescence of the calyx short and glandular is noteworthy but scarcely a good species. I am calling it

P. VIRGINIANA (L.) Benth., var. **granulosa** (Fassett), stat. nov. *P. granulosa* Fassett in RHODORA, xli. 377 (1939). PLATE 786.

On the St. Lawrence var. *granulosa* is on areas covered by high tide; the lower part, at least, of its range on the Susquehanna is tidal shore; on Lake Champlain, where the variety abounds, and on the middle and upper Kennebec it is in areas which have had no extensive tides since the Champlain Subsidence, at which time a fresh arm of the sea entered Lake Champlain and a tongue extended well up the Kennebec. Can it be that the variety originated on Lake Champlain and the upper Kennebec at that period?

PLATE 783. PHYSOSTEGIA ABORIGINORUM Fernald: FIG. 1, TYPE, × ½; FIG. 2, flower, × 2; FIG. 3, mature calices and rachis, × 5.

PLATE 784. P. DENTICULATA (Ait.) Britton: FIG. 1, characteristic plant, × ⅗, from Monroe Bridge, Nottoway River, Southampton County, Virginia, *Fernald & Long*, no. 13,122. P. INTERMEDIA (Nutt.) Engelm. & Gray: FIG. 2, plant, × ½, from Lake City, Craighead County, Arkansas, *Demaree*, no. 5089; FIG. 3, leaf-margin, × 2, from no. 5089.

PLATE 785. PHYSOSTEGIA: FIG. 1, tracing of leaf of type of *Prasium? purpureum* Walt., by Blake. PHYSOSTEGIA ANGUSTIFOLIA Fern.: FIGS. 2–5, *Drummond*, no. 251, × 5/9, said by Blake to match Walter's type of *Prasium? purpureum* (FIG. 1), which is also said to be *Physostegia denticulata* (see PL. 784, FIG. 1); FIG. 5, leaf of no. 251, × 2; FIG. 6, TYPE of PHYSOSTEGIA ANGUSTIFOLIA, × 5/12; FIG. 7, portion of leaf, × 2.

PLATE 786. P. VIRGINIANA (L.) Benth., var. GRANULOSA (Fassett) Fernald: FIGS. 1 (× ½) and 2 (× 2), of isotype of *P. granulosa* Fassett, from Cap Rouge, Quebec, *Victorin*, no. 28,178; FIGS. 3 (× ½) and 4 (× 2) from Kennebec River, Bingham, Maine, *Fassett*, no. 14,341; FIG. 5, × ½, from Lake Champlain, South Hero, Vermont, *Hunnewell*, no. 13,902.

STACHYS CLINGMANII Small. SURRY COUNTY: rich alluvial woods and thickets back of sand-beach of James River, below Sunken Meadow Beach, no. 8446; thicket back of sand-beach of Cobham Bay, James River, northwest of Chippokes, no. 12,788.

Photo. B. G. Schubert.

PHYSOSTEGIA VIRGINIANA, VAR. GRANULOSA: FIG. 1, ISOTYPE, × ½; FIG. 2, portion of leaf of ISOTYPE, × 2; FIG. 3, plants, × ½, from upper Kennebec River, Maine; FIG. 4, leaf, × 2, from the last; FIG. 5, plant, × ½, from Lake Champlain

Photo. B. G. Schubert.

STACHYS TENUIFOLIA: FIG. 1, plant, × ½; FIG. 2, surface of stem, × 10; FIG. 3, lower surface of leaf, × 10; FIG. 4, bracts and flower, × 4

Both numbers have been erroneously reported in previous records as *Stachys Nuttallii* Shuttlew. The latter species of western North Carolina and eastern Tennessee has the sides of the stem minutely glandular-puberulent, the sessile or subsessile leaves glabrous beneath, the glandular and short-pilose calyx with broadly deltoid teeth. Our plant, also of the mountains, thence westward to Illinois, is the *S. Nuttallii* sensu Robinson & Fernald in Gray, Man. ed. 7. Its stems are glabrous on the sides, the membranous leaves slender-petioled and copiously hispid on the veins and veinlets beneath, the calyx glandular and minutely pilose, with narrow teeth long-subulate at tip. On the lower James it is as notable an isolation from the Appalachian Upland as if it were really *S. Nuttallii*.

*S. TENUIFOLIA Willd. CHARLES CITY COUNTY: alluvial woods along James River, Harrison Point, no. 9133. SOUTHAMPTON COUNTY; open sandy alluvial bank of Nottoway River, below Cypress Bridge, and wooded bottomland, Cypress Bridge, nos. 6370 and 8447. GREENSVILLE COUNTY: wooded alluvial bottomland of Meherrin River, near Haley's Bridge, no. 9418. See PLATE and MAP 1.

Apparently typical *Stachys tenuifolia* is not definitely recorded as Virginian. In his *Preliminary Revision of American Stachys* in Fedde, Repert. Sp. Nov. Beih. lxxx. 68 (1934), Epling gives the range "from Western New York and Southeastern Pennsylvania westward to Michigan and Minnesota, and Southwestward through Tennessee and Alabama to Louisiana and Texas". He could have extended it southeastward into Georgia; at least a characteristic specimen from northern Georgia, coll. *Chas. Wright*, correctly identified by Asa Gray and validated by Epling in 1931, is in the Gray Herbarium. True *S. tenuifolia* is, obviously, chiefly a plant of the Interior; its occurrence on the bottomlands of southeastern Virginia is another instance of a now familiar isolation, as is material from river-swamp of Santee River in Charleston County, South Carolina, *Godfrey & Tryon*, no. 728. Epling's only suggestion that *S. tenuifolia* occurs in Virginia is his note that "Specimens collected . . . by K i l l i p (no. 6286) near Great Falls, Virginia, show an apparent intermixture with *S. hispida* chiefly in hairiness of the calyces and the more subulate calyx teeth". Such transitions to *S. hispida* are so frequent that I cannot feel that the two are distinct

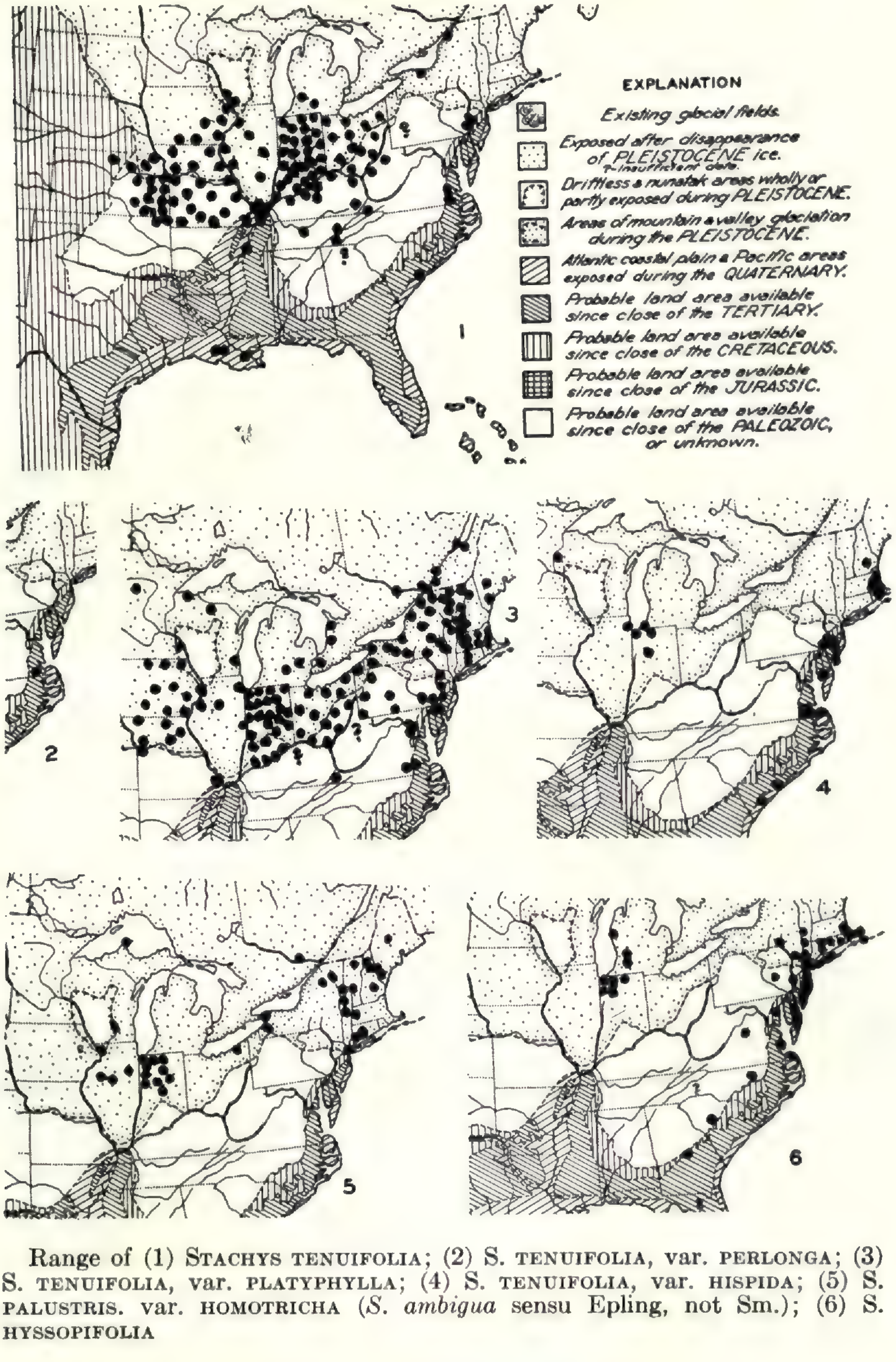
species, but are rather well pronounced geographic varieties. The following number from southeastern Virginia combines too intimately the characters of typical *S. tenuifolia* and those of typical *S. hispida*: Southampton County: bushy swales and borders of swampy woods near Blackwater River, Cobb's Wharf, no. 10,407. As I understand *S. tenuifolia* and *S. hispida* they are the two extremes of a rather polymorphous species, characterized by having the sides of the stem glabrous, the leaves with glabrous lower surfaces or with hispidity along the veins and veinlets but not on the intermediate tissue, and in the calyx being glabrous, or bristly only on the angles, its lance-attenuate teeth soon outwardly curving. As a polymorphous relatively southern species it is distinguished from the more northern (circumboreal) *S. palustris* L., in which the surfaces of the stem are pubescent, the leaves pilose to puberulent beneath, and the surfaces of the calyx pilose. My interpretation of *S. tenuifolia* is shown in the following brief synopsis.

a. Bracts at base of glomerules of spike not ciliate; calyx glabrous throughout; leaves glabrous on both faces, the principal ones with slender petioles 0.5–3 cm. long.
Leaf-blades lanceolate to ovate-oblong or narrowly ovate, one fifth to three fifths as broad as long, the principal ones 4–10 cm. long and 1.2–6 cm. broad; spike stiff . . . . . *S. tenuifolia*, typical.
Leaf-blades narrowly oblong, about one sixth as broad as long; the median ones 1–1.5 dm. long and 1.6–2 cm. broad; spike flexuous . . . . . Var. *perlonga.*

a. Bracts bristly-ciliate; calyx often bristly on the angles; leaves often hispid on veins beneath, sessile, or the lower ones short–petioled.
Principal leaves broadly oblong to narrowly ovate, one third to three fifths as broad as long, 5–15 cm. long, 2–6 cm. broad, glabrous to sparsely strigose above. Var. *platyphylla.*
Principal leaves narrowly lanceolate to narrowly lance-oblong, one sixth to one fourth as broad as long, 3–10 cm. long, 0.8–2.4 cm. broad, mostly strigose above . . . Var. *hispida.*

S. tenuifolia Willd. Sp. Pl. iii. 100 (1800). *S. glabra* Riddell, Suppl. Cat. Ohio Pl. 16 (1836). *S. aspera*, var. *glabra* Gray, Syn. Fl. N. Am. ii[1]. 387 (1878). *S. cincinnatensis* Ktze. Rev. Gen. ii. 531 (1891).—Rich bottomlands, shores, low woods and meadows, New York to Minnesota, south to southeastern South Carolina, northern Georgia, Tennessee, northern Louisiana and eastern Texas. Plate 787 and map 1.

*Var. **perlonga,** var. nov. (tab. 788, fig. 1 et 2), var. typicae simillima; foliis anguste oblongis, mediis 1–1.5 dm. longis 1.6–2 cm. latis; spica flexuosa. Virginia: bottomland woods



Range of (1) STACHYS TENUIFOLIA; (2) S. TENUIFOLIA, var. PERLONGA; (3) S. TENUIFOLIA, var. PLATYPHYLLA; (4) S. TENUIFOLIA, var. HISPIDA; (5) S. PALUSTRIS. var. HOMOTRICHA (*S. ambigua* sensu Epling, not Sm.); (6) S. HYSSOPIFOLIA

along Meherrin River northeast of Gaskins, Greensville County, June 13, 1941 (foliage), August 8, 1941 (flowers and young fruit), nos. 13,128 and 13,435 (TYPE in Herb. Gray.; ISOTYPE in Herb. Phil. Acad.). MAP 2.

*Var. **platyphylla,** var. nov. (TAB. 789), caule ad angulos retrorse setoso; foliis primariis late oblongis vel anguste ovatis 5–15 cm. longis 2–6 cm. latis supra glabris vel sparse strigosis subtus ad venas hispidis vel glabris.—Low woods, rich shores and meadows, southern Quebec to Minnesota, south to eastern South Carolina, western North Carolina, Indiana and Illinois. The following, selected from a large series, are characteristic. QUEBEC: sur les rivages du Fleuve St.-Laurent, St.-Francois, Ile d'Orleans, 13 juillet 1935, *Victorin et al.*, no. 43,661; rivages Fl. St.-Laurent, Berthier en Bas, 3 août 1925, *Rousseau*, no. 21,610; Valleyfield, Co. Beauharnois, 6 septembre 1930, *Victorin, & Rolland*, no. 33,953; rivage, Ile Plate, Longueuil, 28 août 1928, *Victorin*, no. 28,272. MAINE: East Livermore, July 5, 1909, *Kate Furbish;* by small pond, Portland, June 20, 1909, *Fernald*, no. 2158. NEW HAMPSHIRE: bank of Connecticut River, Stratford, September 3, 1909, *Pease*, no. 17,705. VERMONT: pebbly lake-shore, Highgate Springs, July 19, 1938, *Pease*, no. 26,746; sandy shore of Connecticut River, Norwich, July 11, 1910, *E. F. Williams* (TYPE in Herb. Gray.); sandy bank, Burlington, July 8, 1914, *C. H. Knowlton;* pebbly shore, Brattleboro, 1894, *Grout.* MASSACHUSETTS: Sudbury, July 19, 1886, *W. Deane;* bank of Neponset River between upper and lower falls, Milton, August 29, 1853, *Wm. Boott;* roadside, Wellesley, July 11, 1896, *Hunnewell;* Middleboro, August 11, 1901, *J. Murdoch, jr.;* edge of thicket, Northampton, July 23, 1932, *Hunnewell*, no. 12,496; bank of Connecticut River, Springfield, July 13, 1914, *Luman Andrews.* CONNECTICUT: bank of Connecticut River, East Windsor, July 13, 1902, *Bissell;* South Meadow, Hartford, July 7, 1908, *H. S. Clark.* NEW YORK: shores of Black Lake, Morristown, August 15, 1914, *Phelps*, no. 814; Mohawk flats east of Utica, July 18, 1900, *Haberer*, no. 709; Sylvan Beach, Oneida County, July 13, 1916, *House;* bank of Hudson River, near Cedar Hill, south of Albany, July 17, 1910, *Burnham;* wet gravelly soil, Ulysses, July 1, 1913, *E. L. Palmer*, no. 1039; moist thicket near Cold Spring, Alleghany State Park, July 30, 1926, *Alexander & House*, no. 12,783. NEW JERSEY: marsh, Rosenkraus Ferry, Delaware River, Sussex County, July 4, 1918, *E. B. Bartram;* wet ground, Kaign's Point, Camden, June 21, 1922, *Meredith;* border of tidal marsh along Delaware River, north of Penns Grove, August 9, 1935, *Fogg*, no. 9309. PENNSYLVANIA: Sellersville, July 18, 1923, *Fretz;* Greene County, July 2, 1923, *S. S. Dickey;* Presque Isle, June 29, 1922, *Dickey.* VIRGINIA: swampy woods near Nottoway River at Readjuster Bridge, south of

Photo. B. G. Schubert.

STACHYS TENUIFOLIA, var. PERLONGA: FIG. 1, ISOTYPE, × ⅖; FIG. 2, bracts and calices, × 4

S. HYSSOPIFOLIA: FIG. 3, plant, × ½; FIG. 4, bract and calyx, × 4; FIG. 5, nutlet, × 10

Photo. B. G. Schubert.

STACHYS TENUIFOLIA, var. PLATYPHYLLA: FIG. 1, TYPE, × ⅖; FIG. 2, surface of stem, × 10; FIG. 3, lower surface of leaf, × 10; FIG. 4, rachis, bracts and calices, × 4; FIG. 5, nutlet, × 10

Peanut, Sussex County, June 18, 1941, *Fernald & Long*, no. 13,129; along branch, south of Meherrin River, south of Western Bridge, Brunswick County, *J. B. Lewis*, nos. 2800 and 3538. South Carolina: Woodstock, 1833, *Gibbes* in Herb. N. Y. Bot. Gard. Ontario: Ottawa, August 8, 1894, *J. Macoun*, no. 5852; Wingham, July 24, 1894, *J. A. Morton;* Chippewa, July 5, 1858, *Wm. Boott.* Michigan: near river, Flint, July 21, 1909, *Sherff;* Agricultural College, July 25, 1896, *C. F. Wheeler.* Ohio: Troy, Geauga County, July 21, 1904, *R. J. Webb*, no. 716; Sandusky, August 1, 1894, *Moseley;* Rocky River, near Cleveland, July 13, 1896, *Greenman*, no. 1403; Painesville, July 19, 1885, *Werner*, no. 342; Sugar Grove, Fairfield County, August 6, 1892, *Werner*, no. 343; near Cincinnati, July 9, 1888, *C. G. Lloyd.* Wisconsin: Fort Wing, July 10, 1897, *L. S. Cheney*, no. 7166. Illinois: Stony Island, Cook County, June 30, 1914, *H. H. Smith*, no. 5974; damp woods, Peoria, July, 1903, *F. E. McDonald;* banks of Mississippi, near Oquawka, July 18, 1872, *Patterson.* Minnesota: Lake City, August 13, 1883, *W. H. Manning.* Map 3.

Var. **hispida** (Pursh), comb. nov. *S. hispida* Pursh, Fl. Am. Sept. ii. 407 (1814). *P. tenuifolia*, var. *aspera* sensu Fernald in Rhodora, x. 85 (1908), not *S. aspera* Michx., basonym. *S. ambigua* sensu Robinson & Fernald in Gray, Man. ed. 7: 701 (1908), not *S. ambigua* (Gray) Britton.—Meadows, swamps, low woods and shores, southern New Hampshire, eastern Massachusetts and Rhode Island, eastern New York, south to eastern South Carolina; Michigan, Wisconsin, Indiana and Illinois. The following selected from a large series, are typical. Massachusetts: tidal bank of Merrimac River, Newburyport, *Donald White*, no. 501; near Concord River, Lowell, July 14, 1880, *C. W. Swan;* riverbank, Concord, July 17, 1886, *Deane;* Prince's Pond, Needham, August 2, 1884, *T. O. Fuller;* Neponset River, Hyde Park, July 10, 1904, *A. W. Cheever;* Pine Tree Brook, Milton, July 13, 1911, *Churchill;* Dedham, July 18, 1891, *Churchill;* wet meadows, Dover, *St. John*, no. 594; open bog, Sharon, July 12, 1896, *E. F. Williams;* sandy pond-shore, Walpole, *Hunnewell*, no. 6779; Middleboro, *Richard Murdoch*, no. 933; Taunton, *F. C. Seymour*, no. 4187. Rhode Island: Providence, July, 1844, *Thurber;* Bristol, *F. S. Collins*, no. 2358; grassy bank near salt marsh, Portsmouth, July 11, 1909, *Sanford.* New York: various specimens from eastern counties intermediate between this and the preceding variety, none fully characteristic. New Jersey: along streamlet 1 mile northeast of Delanco, Burlington County, *Long*, no. 6354; fresh marshes along Wading River, New Gretna, Burlington County, *Long*, no. 10,574; rich bog along railroad, Cold Spring, Cape May County, August 29, 1922, *Fogg.* Pennsylvania: Tinicum, Delaware County, August, 1873, *Chas. Schaeffer;* meadow near Red Clay Creek,

Kennett Square, Chester County, June 28, 1924, *Mary A. Williams*. MARYLAND: King's Creek, *J. A. Holmes*, no. 98. VIRGINIA: wet argillaceous thickets and ditches, Rosemont, Princess Anne County, *Fernald & Long*, no. 5017; fresh reed-marsh and swale along Northwest River near Northwest, Norfolk County, *F. & L.*, no. 14,005; alluvial woods, along Nottoway River at Readjuster Bridge, south of Peanut, Sussex County, *F. & L.*, no. 12,459; bushy swales and borders of swampy woods near Blackwater River, Cobb's Wharf, Southampton County, *F. & L.*, no. 10,407 (transition to typical *S. tenuifolia*); alluvial woods by Fontaine Creek, west of Dahlia, Greensville County, *F. & L.*, no. 14,399; peaty and argillaceous clearing about 4 miles southeast of Emporia, *F. & L.*, nos. 8445 and 8834; bottom-land woods along Meherrin River northeast of Gaskins, Greensville County, *F. & L.*, no. 13,434. SOUTH CAROLINA: wet ditch, thicket, 13 miles east of Walterboro, Colleton County, *Wiegand & Manning*, no. 2793; border of swamp, 12 miles north of Georgetown, *Godfrey & Tryon*, no. 1067. MICHIGAN: near river, New Buffalo, *Lansing*, no. 3262. INDIANA: low place in woods, about 1 mile southeast of Woodland, St. Joseph County, *Deam*, no. 50,459; damp prairie, Roby, *Lansing*, no. 2542; Frankfort, June 27, 1886, *H. A. Young*. WISCONSIN: St. Croix Falls, July 8, 1900, *C. F. Baker*. ILLINOIS: open field, South Chicago, *H. H. Smith*, no. 5684. PLATE 790 and MAP 4. See p. 369.

Stachys hispida Pursh, typified by Epling by a Clayton specimen from Virginia (presumably in the eastern section), is, according to the description and as indicated by Epling's note on a sheet in the Gray Herbarium, this narrow-leaved extreme. Var. *hispida* has, so far as material before me shows, the broken range of many Coastal Plain types, great concentration in eastern Massachusetts and adjacent Rhode Island, absence from Connecticut and much, if not all, of New York, reappearance farther south, and with an area centering on Lake Michigan and running into Wisconsin. In Massachusetts, New Jersey, eastern Pennsylvania and eastern Virginia it tends to grow in more acid habitats than var. *platyphylla*, the latter preferring the sweeter and richer soils, as does typical *S. tenuifolia*.

The confusion of *Stachys hispida* with *S. aspera* Michaux arose through unfamiliarity with the latter. A photograph of the Michaux type now before me shows it to be, as identified by Epling, the southern plant which Gray (1878) described from Georgia, Kentucky and Illinois as *S. hyssopifolia* Michx., var.

Photo. B. G. Schubert.

STACHYS TENUIFOLIA, var. HISPIDA: FIG. 1, plant, × ½; FIG. 2, portion of stem, × 10; FIG. 3, lower surface of leaf, × 10; FIG. 4, rachis, bracts and calices, × 4

Photo. B. G. Schubert.

STACHYS AMBIGUA: FIG. 1, summit of plant, × ½; FIG. 2, portion of stem, × 10; FIG. 3, calices, × 4

ambigua. It was soon called *S. ambigua* (Gray) Britton (1894) but, on account of the earlier European *S. ambigua* Sm. (1810), the name was changed to *S. Grayana* House (1921). *S. aspera,* described from "*in campestribus* Carolinae", is a plant of sands and prairies from northern Florida to eastern Missouri, north to southern New Jersey, southeastern Pennsylvania, Kentucky, Illinois and Iowa; also adventive as a field-weed in Somerset County, Maine. It is, as Gray considered it, very close to *S. hyssopifolia* Michx., having the firm and scarcely veiny leaves almost of the latter but mostly broader, their lowest lateral nerves prolonged very close to the margin of the blade. From glabrous *S. hyssopifolia* it is distinguished only by the stems more or less retrorse-hispid on the angles, leaves sometimes broader and more regularly depressed-serrate, upper bracts often broadly-lanceolate to ovate (instead of linear or narrowly lanceolate), calyx often minutely pilose (instead of quite glabrous) and frequently setose on the angles. Gray's disposition of it, as *S. hyssopifolia,* var. *ambigua,* seems wholly justified. In the Carolinas and northeastward there are altogether too many transitions to support its separation as a species.

In his *Revision* Epling, l. c. 65, 66, including with the narrow-leaved *S. tenuifolia,* var. *hispida,* as above defined (PLATE 790), the generally more inland var. *platyphylla* (PLATE 789) as a species, *S. hispida,* was "inclined to believe *S. hispida* to have been derived from *S. ambigua,* probably after intermixture with *S. hyssopifolia*". He identified as *S. ambigua* Sm. Engl. Bot. xxx. pl. 2089 (1810) the very pilose and narrow-leaved extreme of *S. palustris* L. which I had described as *S. palustris,* var. *homotricha* Fernald in RHODORA, x. 85 (1918), which he also identified with the similarly long-pilose *S. velutina* Schwein. (1824), not Willd. (1813) and *S. arenicola* Britton (1901). Just why *S. ambigua* sensu Epling (PLATE 793) is identified with *S. ambigua* Sm., the European plant (PLATE 791), is not clear. He was advised of the error but did not wholly admit it, saying, p. 65, "Since the above was written I have had the privilege of discussing this form with Prof. G ö t e T u r e s s o n who is of the opinion that I have mis-interpreted the European hybrid *S. ambigua.* This, according to him is a rare and sterile plant. Until I can review the whole matter I am accordingly at as [a]

loss. Suffice it to say that the form here described as *S. ambigua* is scarcely to be distinguished from plants commonly referred to that species of European botanists".

Now, *Stachys palustris*, var. *homotricha* (PLATE 793), i. e. *S. ambigua* sensu Epling, is a stiff and normally simple-stemmed plant with the sides and angles of the stem and the rachis densely and retrorsely long-pilose or villous (FIGS. 2 and 3), the lanceolate to lance-linear leaves sessile and heavily pubescent beneath (FIG. 2), the calyx long-hirsute (FIGS. 2–5), the outside of the corolla strongly pilose. It occurs from Maine and southern Quebec to Wisconsin, south to Connecticut, southern New York, Ohio and Illinois (MAP 5). *S. ambigua* Sm., on the other hand, is a generally recognized sterile hybrid of typical European *S. palustris* (the latter only naturalized in Newfoundland, eastern Canada, New England and New York) and the endemic European *S. sylvatica* L., a plant with long-petioled cordate-ovate leaves. As shown by Smith's original plate and description and by many European specimens (our PLATE 791) it is a tall and loosely branched plant with the stem (FIG. 2) minutely strigose-pilose, the principal leaves definitely petioled, the divergent oblong-ovate blades minutely pilose beneath, the calyx short-pilose (FIG. 3) and the corolla only finely pilose. If it is inseparable from the indigenous North American *S. palustris*, var. *homotricha* (PLATE 793), it is time to give up.

As to Epling's belief that *Stachys hispida* in his sense, *i. e.* both *S. tenuifolia* var. *platyphylla* (PLATE 789 and MAP 3) and var. *hispida* (PLATE 790 and MAP 4), was derived from his "*S. ambigua*" (taking it for the American plant cited by him, our PLATE 793, and *S. hyssopifolia* Michx. (PLATE 788, FIGS. 3–5 and MAP 6) one may be pardoned a gasp of surprise. *S. palustris*, var. *homotricha* (*S. ambigua* sensu Epling) is shown in PLATE 793, *S. tenuifolia*, vars. *hispida* and *platyphylla* (*S. hispida*, inclusive, of Epling) in PLATES 790 and 789. Together the latter have a wide continental dispersal (MAPS 3 and 4), while *S. palustris*, var. *homotricha* is northern and within the northern range of the former. *S. hyssopifolia* (PLATE 788, FIGS. 3–5), is primarily a plant of the Atlantic Coastal Plain, but with the typical isolation at the head of Lake Michigan (MAP 6). It is strictly glabrous, with linear to narrowly oblong blunt to subacute, firm, pale,

entire leaves, so firm that, when fresh, only the midrib shows beneath, but, by transmitted light its leaves show the lower lateral veins following forward within 0.3–1 mm. from the margin, and its subglobose nutlets (FIG. 5) are only 1.5–1.8 mm. long. *S. hispida* and *S. ambigua* sensu Epling are both pubescent. Their leaves are from narrowly lanceolate to oblong-ovate and usually pubescent, veiny, with the lower pair of laterals following forward from 3–10 mm. within the copiously toothed margin, and their tips are acuminate; the nutlets (PLATE 792, FIG. 4) of *S. palustris* are ellipsoid-obovoid and 1.8–2.2 mm. long, those of *S. tenuifolia*, including *S. hispida*, similar and 2.1–2.7 mm. long (PLATE 788, FIG. 5). Just how, by crossing the narrow-, blunt- and firm-leaved, chiefly Coastal Plain *S. hyssopifolia* (PLATE 788, FIGS. 3–5) with the narrow-leaved continental and northern and by Epling misidentified *S. "ambigua"* (PLATE 793), with leaves 1–3 cm. wide, one gets the wide-ranging *S. hispida* sensu Epling (PLATES 789 and 790), with no trace of the pubescence of *S. "ambigua"* on stem, leaves and calyx and with leaves up to 6 cm. broad, is beyond my understanding. Is this modern phylogeny?

OUR VARIETIES OF STACHYS PALUSTRIS (PLATE 792–794)—During this study of *Stachys* it has been necessary to unravel our variations of *S. palustris*. This is a northern, circumboreal species with two pronounced subspecies, each with several geographic varieties. Typical Eurasian *S. palustris* L. has the calyx (PLATE 792, FIG. 3) closely viscid-pilose with many gland-tipped hairs mixed with short glandless ones, the latter rarely more than 1 mm. long. It and three of the varieties recognized in Europe are naturalized about towns and settlements, often about ports, in various parts of Newfoundland, Quebec, eastern Ontario, the Maritime Provinces, New England and New York. The native North American plants differ in having the calyx long-hirsute as well as short-pilose, the shorter pubescence largely hidden by long whitish and glandless setiform trichomes mostly 1.5–3 mm. long. This is subsp. *pilosa* (Nutt.) Epling, based on *S. pilosa* Nutt. in Journ. Acad. Phil. vii. 48 (1834). The native subsp. *pilosa* consists, in the Gray's Manual range, of five rather well defined varieties. These I am distinguishing as follows.

a. Leaves sessile or on very short and inconspicuous thick petioles....*b.*

b. Principal leaves oblong to oblong-ovate or oval, blunt or merely subacute, three tenths to one half as broad as long, 3.5–12 cm. long, 1.5–5 cm. broad; chiefly western...Var. *pilosa.*

b. Principal leaves narrowly to broadly lanceolate or narrowly oblong, acuminate, one seventh to one third as broad as long, 2–13 cm. long, 0.4–3 cm. broad; chiefly eastern and northern....*c.*

c. Pubescence of sides of stem many times shorter than that of angles, or minute and with long hairs of angles wanting.

Angles of stem retrorsely long-hirsute, sides short-pilose; leaves lanceolate to oblong, the principal ones 4–13 cm. long and 0.8–3 cm. broad, strongly hispid on the veins and pilose on the surfaces beneath; boreal and transcontinental.....Var. *nipigonensis.*

Angles of stem with few or no long hairs, sides minutely and retrorsely appressed-pilose-puberulent; leaves narrowly lanceolate, the principal ones 2–5.5 cm. long and 0.4–1.5 cm. broad, sparsely and minutely puberulent to glabrous beneath; plant of Upper Great Lakes region.....Var. *macrocalyx.*

c. Pubescence of sides of stem very dense and long, as long as and not readily distinguished from that of the angles.....Var. *homotricha.*

a. Leaves slender-petioled, the petioles of the principal ones 1–1.4 cm. long, the oblong or lance-ovate acuminate blades mostly 6–12 cm. long and 2–4 cm. broad; angles of stem with relatively few or no long hairs.....Var. *phaneropoda.*

S. PALUSTRIS L., var. **pilosa** (Nutt.), stat. nov. *S. pilosa* Nutt. in Journ. Acad. Phil. vii. 48 (1834). Subsp. *pilosa* (Nutt.) Epling in Fedde, Repert. Beih. lxxx. 63 (1934). *S. scopulorum* Greene, Pittonia, iii. 342 (1901).—Shores, stream-margins, meadows, etc., British Colombia to Arizona, east to Ontario, Wisconsin, Illinois, Nebraska, and adventive along railroads and in waste places eastward to New England (several collections from near stations along the Canadian Pacific and Grand Trunk Railroads).

Var. NIPIGONENSIS Jennings in Journ. Wash. Acad. Sci. x. 459 (1920).—Low grounds, Quebec to Alaska, south to western New England, New York, Ohio, Michigan, Illinois, Iowa, New Mexico and Arizona.

Var. MACROCALYX Jennings, l. c. 458 (1920).—Shores, Thunder Bay District, Ontario, to northern Wisconsin and northern Minnesota.

Var. HOMOTRICHA Fernald in RHODORA, x. 85 (1908). *S. velutina* Schweinitz in Long's Exped. Winnip. ii. 390 (1824), not Willd. (1813). *S. arenicola* Britt. Man. 792 (1901). *S. palustris*, var. *arenicola* (Britt.) Farw. in Am. Midl. Nat. xl. 82 (1928). *S. Schweinitzii* Rydb. in Brittonia, i. 95 (1931). *S. homotricha* (Fern.) Rydb. l. c. (1931). *S. pustulosa* Rydb. l. c. (1931).—

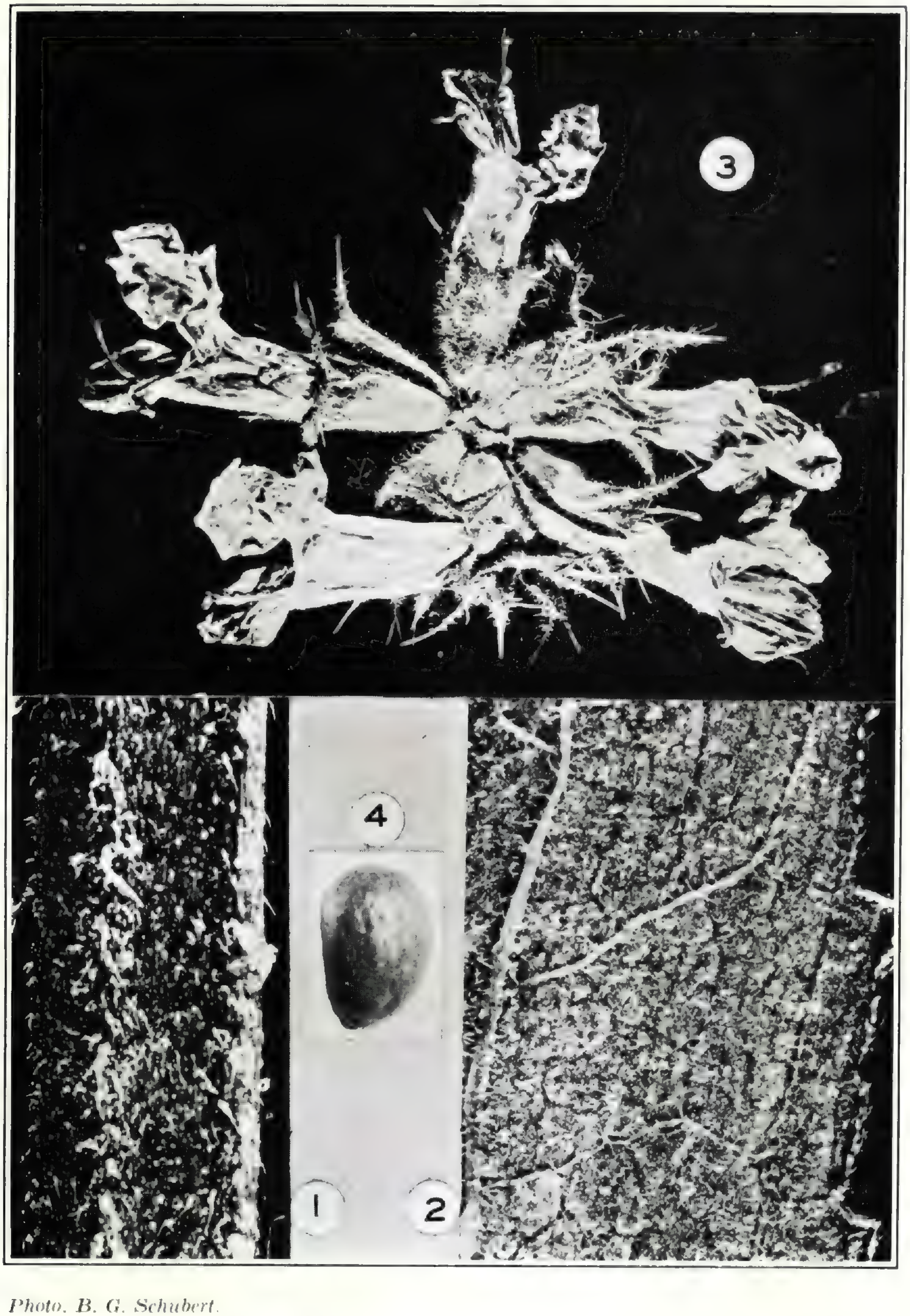


Photo. B. G. Schubert.

STACHYS PALUSTRIS: FIG. 1, portion of stem, × 10; FIG. 2, lower leaf-surface, × 10; FIG. 3. bracts and flowers, × 4; FIG. 4. nutlet, × 10

Photo. B. G. Schubert.

STACHYS PALUSTRIS, VAR. HOMOTRICHA: FIG. 1, one of TYPE-specimens, × ⅜; FIG. 2, lower bracts and calyx, × 4, from TYPE; FIG. 3, stem and lower surface of leaf-base, × 10, from TYPE; FIG. 4, narrow-leaved plant (*S. arenicola* Britt.), × ½; FIG. 5, calyx of the last, × 10

Shores, meadows and fields, Maine and southern Quebec to Wisconsin, south to Connecticut, New York, Ohio and Illinois. PLATE 793, MAP 5.

Var. **phaneropoda,** var. nov., Weatherby in herb. (TAB. 794) foliis petiolatis, petiolis (foliorum principalium) 1–1.4 cm. longis, laminis oblongis vel lanceolato-ovatis 6–12 cm. longis, 2–4 cm. latis; setis in angulis caulis ex comparatione paucis vel carentibus. OHIO: Port Clinton, Ottawa County, July 31, 1894, *Moseley*. WISCONSIN: Spooner, July 20, 1911, *J. J. Davis*. IOWA: riverbank, Estherville, July 31, 1925, *B. O. Wolden*, no. 1118, TYPE, in Herb. Gray.

PLATE 787. STACHYS TENUIFOLIA Willd.: FIG. 1, plant, × ½, from Cypress Bridge, Nottoway River, Southampton County, Virginia, *Fernald & Long*, no. 6370; FIG. 2, surface of stem, showing lack of pilosity, × 10, FIG. 3, lower surface of leaf, × 10, and FIG. 4, bracts and flower, × 4, all from James River at Harrison Point, Charles City County, Virginia, *Fernald & Long*, no. 9133.

PLATE 788, FIGS. 1 and 2, S. TENUIFOLIA, VAR. PERLONGA Fernald: FIG. 1, ISOTYPE, × ⅖; FIG. 2, bracts and calices, × 4. FIGS. 3–5, S. HYSSOPIFOLIA Michx.: FIG. 3, plant, × ½, from southeast of Yorktown, Virginia, *Fernald & Long*, no. 8835; FIG. 4, bract and mature calyx, × 4, from south of Yorktown, *Fernald, Long & Fogg*, no. 5016; FIG. 5, nutlet, × 10, from Sandwich, Massachusetts, October 23, 1922, *Fernald*.

PLATE 789. S. TENUIFOLIA, VAR. PLATYPHYLLA Fernald: FIG. 1, TYPE, × ⅖; FIG. 2, surface of stem, the pustular-based hairs of the angles bent by pressing, × 10, from Alburg, Vermont, July 16, 1939, *C. H. Knowlton;* FIG. 3, lower surface of leaf, × 10, and FIG. 4, rachis, bracts and calices, × 4, from same place as FIG. 2; FIG. 5, nutlet, × 10, from Chaumont, New York, *Fernald, Wiegand & Eames*, no. 14,429.

PLATE 790. S. TENUIFOLIA, VAR. HISPIDA (Pursh) Fernald: FIG. 1, plant, × ½, from Rosemont, Princess Anne County, Virginia, *Fernald & Long*, no. 5017; FIG. 2, portion of stem, with nearly glabrous sides but strongly hirsute angles, × 10, FIG. 3, lower surface of leaf, × 10, and FIG. 4, rachis, bracts and calices, × 4, from Sharon, Massachusetts, July 12, 1896, such plants from Sharon specially noted in Gray Herb., by Epling, as like Pursh's type.

PLATE 791. S. AMBIGUA Sm.: FIG. 1, summit of plant, × ½, from Borgholm, Öland, Sweden, July 20, 1886, *Areskug;* FIG. 2, portion of stem, × 10, from same plant; FIG. 3, calices, × 4, from Austria, *Bot. Tauschver. Wien.*

PLATE 792. S. PALUSTRIS L.: FIG. 1, portion of stem, × 10, from Bouillon, Belgium, August 10, 1933, ex *Herb. Hort. Brux.;* FIG. 2, lower surface of leaf, × 10, and FIG. 3, two whorls of flowers, × 4, from same collection; FIG. 4, nutlet, × 10, from ballast-filling, York, Gaspé County, Quebec, *Collins, Fernald & Pease* (*Pease*, no. 5062½).

PLATE 793. S. PALUSTRIS, VAR. HOMOTRICHA Fernald (*S. ambigua* sensu Epling, not Sm.): FIG. 1, plant of TYPE, × ⅜; FIG. 2, lower bracts and calyx, × 4, from TYPE; FIG. 3, stem and lower surface of leaf-base, × 10, from TYPE; FIG. 4, narrow-leaved extreme (*S. arenicola* Britton), × ½, from Copper Harbor, Michigan, *Farwell*, no. 281); FIG. 5, two calices, × 4, from no. 281.

PLATE 794. S. PALUSTRIS, VAR. PHANEROPODA Weatherby: FIG. 1, TYPE, × ½; FIG. 2, stem, × 4; FIG. 3, calyx, × 10.

PYCNANTHEMUM VERTICILLATUM (Michx.) Pers. A second Coastal Plain station, this in NORFOLK COUNTY: damp old clearings and thickets, eastern side of Great Dismal Swamp, north of Wallaceton, nos. 13,736 and 14,007.

P. PYCNANTHEMOIDES (Leavenw.) Fern., var. VIRIDIFOLIUM Fern. A second Coastal Plain station, this in SOUTHAMPTON COUNTY: border of dry woods northeast of Adams Grove, no. 14,398.

VERBENA OFFICINALIS L. To the relatively few stations add one in SOUTHAMPTON COUNTY: roadside bordering Womble's (Wade's) Millpond, north of Baffle, no. 14,395.

PHYSALIS MONTICOLA C. Mohr. Range extended northeastward to ISLE OF WIGHT COUNTY: sandy wooded slope by Blackwater River, west of Blackwater School, no. 14,400, unusually large, up to 3.5 dm. high. See p. 370.

*LINARIA CANADENSIS (L.) Dumort., forma **albina,** f. nov., corollis albidis.—VIRGINIA: burned spot, white sand of dry pine barrens, south of Lee's Mill, Isle of Wight County, April 21, 1942, *Fernald, Long & Abbe*, no. 14,230 (TYPE in Herb. Gray.).

GRATIOLA VIRGINIANA L., var. AESTUARIORUM Pennell. Range extended inland to BRUNSWICK COUNTY: open mud by Triplett Pond, Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,497. See p. 380.

UTRICULARIA PURPUREA Walt. Local range extended inland to SUSSEX COUNTY: Harold's (or Harris) Millpond, southeast of Waverly, no. 14,408. See p. 371.

U. INFLATA Walt. Local range extended inland to SUSSEX COUNTY: back-water pool by Nottoway River at Readjuster Bridge, south of Peanut, *Fernald, Long & Abbe*, no. 14,231.

U. INFLATA, var. MINOR Chapm. To the very few recorded stations add the following. SOUTHAMPTON COUNTY: quiet pool in cypress swamp bordering Womble's (Wade's) Millpond, north of Baffle, no. 14,406. SUSSEX COUNTY: Harold's (or Harris) Millpond, southeast of Waverly, no. 14,407. See pp. 371 and 372.

U. VIRGATULA Barnhart. To the few recorded stations add one in SOUTHAMPTON COUNTY: on a decaying log in mossy margin of *Cephalanthus*-pool near Johnson's Millpond, north of Sedley, no. 14,411. See p. 371.

OLDENLANDIA BOSCII (DC.) Chapm. To the only two recorded Virginia stations, in southern Southampton County, add the following. SUSSEX COUNTY: sandy-muddy shore, Brittle's Millpond, west of Wakefield, no. 14,417; sandy beach, Airfield Millpond, southwest of Wakefield, no. 14,419. SOUTHAMPTON COUNTY: sandy shore of Johnson's Millpond, 1½ miles north of Sedley, no. 14,416. ISLE OF WIGHT COUNTY: muddy and swaley shore of Darden's Pond, southeast of Collosse, no. 14,418. See pp. 371 and 372.

*LOBELIA SIPHILITICA L., forma **laevicalyx,** f. nov., foliis glabris; caulibus vix pubescentibus; calycibus corollisque glabris.—Isle of Wight County, VIRGINIA: seeping argillaceous and calcareous bluffs along Burwell's Bay, James River, below Rush-

Photo. B. G. Schubert.

STACHYS PALUSTRIS, var. PHANEROPODA, all figs. from TYPE: FIG. 1, plant × ½; FIG. 2, surface of stem, × 4; FIG. 3, calyx, × 10

Photo. B. G. Schubert.

GNAPHALIUM PEREGRINUM, TYPE, × 3/5

mere (Fergusson's Wharf), August 27 and 29, 1940, *Fernald & Long*, no. 12,834, October 10, 1941, *Fernald & Long*, no. 14,030 (TYPE in Herb. Gray; ISOTYPE in Herb. Phil. Acad.).

My attention was directed to this extremely smooth form by Dr. Wray M. Bowden of the Central Experimental Farm at Ottawa, Ontario. I had supplied Dr. Bowden with seeds from no. 14,030 and from some other species in the autumn of 1941. On October 14, 1942, I received from him a letter from which the following passages are extracted:

"Just a note to ask if you could examine your specimen of *Lobelia siphilitica* L., *Fernald and Long*, no. 14,030 . . . You sent seed from this last year and the plants have grown well. The row was quite uniform but not at all like any of the numerous collections of *L. siphilitica* which I have. The stems and leaves are glabrous. The upper leafy bracts in the flower-spike are much longer and pointed, and the calyx is not nearly as pubescent—in fact only the free ends of the lobes are pubescent. The row was quite uniform both in respect to these characters and to colour of corolla which was light blue. . . The corolla is quite glabrous also."

The original specimens have the leaves, calyx and corolla quite glabrous, but the stem is remotely hispid. Other collections from calcareous bluffs of the James are more pubescent. The plant below Rushmere seems to me best treated as a forma, typical *L. siphilitica* having the stem and one or both faces of the leaves variously pubescent, the calyx always more or less so and the tips of the corolla-lobes bearded. Among these more typical plants I find some with quite as prolonged bract-tips as in the Rushmere plant.

L. GLANDULIFERA (Gray) Small. Local range extended into Brunswick County: sphagnous thicket, "Ram Hole Swamp", Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,500. See p. 377.

*EUPATORIUM ROTUNDIFOLIUM L., var. **cordigerum,** var. nov., planta robusta ad 1.3 m. alta caule densissime albido-piloso-tomentuloso; foliis mediis late ovatis subacutis sessilibus valde cordatis 5–8.5 cm. longis 4–7 cm. latis subaequaliter dentatis subtus dense pilosis.—VIRGINIA: upper border of fresh reed-marsh and swale along Northwest River near Northwest, Norfolk County, June 30, 1942, *Fernald & Long*, no. 14,426 (TYPE in Herb. Gray.; ISOTYPE in Herb. Phil. Acad.); mossy thicket by *Cephalanthus*-pool near Johnson's Millpond, north of Sedley, Southampton County, July 4, 1942, *Fernald & Long*, no. 14,427, October 14, 1942, *Fernald*, no. 14,502. NORTH CAROLINA: roadside near Windsor, Bertie County, October 15, 1938, *Godfrey*, no. 7007. See pp. 369 and 371.

Var. *cordigerum* is a very extreme variation in the polymorphic *Eupatorium rotundifolium*. In size of plant and of foliage it suggests the wide-ranging var. *ovatum* (Bigel.) Torr. (*E. pubescens* Muhl.) but its dense pubescence is more like that of typical small-leaved *E. rotundifolium*. In its strongly cordate, instead of gradually rounded, leaf-bases it is very striking, the cordate bases of the middle and upper leaves reaching nearly around the stem.

LIATRIS GRAMINIFOLIA Willd., var. SMALLII (Britt.) Fern. & Grisc. Local range extended into SUSSEX COUNTY: damp sandy pine and oak woods south of Stony Creek, no. 11,455.

BOLTONIA CAROLINIANA (Walt.) Fern. Range extended inland to BRUNSWICK COUNTY: bottomland woods above Western Bridge, Meherrin River, south of Edgerton, *Fernald & Lewis*, no. 14,512, rays pink. See p. 379.

*ERIGERON STRIGOSUS Muhl., forma DISCOIDEUS (Robbins) Fern. NANSEMOND COUNTY: open ground along highway, northern border of Great Dismal Swamp, east of Magnolia, no. 14,436.

*SOLIDAGO SALICINA Ell. BRUNSWICK COUNTY: open bog near Seward Forest Headquarters, September 14, 1940, *J. B. Lewis;* boggy thicket, "Ramhole" Swamp, Seward Forest, Triplett, *Fernald & Lewis*, no. 14,506.—Extension northward from Wake County, North Carolina; most specimens (from North and South Carolina and west to Texas) previously confused with the northern and upland calcicolous *S. patula*. See p. 377.

S. salicina is a very definite southern species of acid bogs of the inner Coastal Plain and outer Piedmont, at once distinguished from *S. patula* by its narrower and more crenate leaves, the cauline ones 20–45 (in *S. patula* 12–23) and rapidly reduced in size, the more open panicle with more elongate and glabrescent branches floriferous at tip, the long-pedicelled heads borne strictly along the upper sides of the branches (in *S. patula* the shorter-pedicelled heads tending to be in short racemes subspirally borne along the white-pilose panicle-branches).

GNAPHALIUM SPATHULATUM A LATER HOMONYM (PLATE 795, the TYPE, × 2/5).—It seems to have been overlooked that *Gnaphalium spathulatum* Lam. Encycl. ii. 758 (1786) is antedated by *G. spatulatum* Burm. f. Fl. Cap. Prodr. 25 (1768) which was the binomial based directly on the well described *Elychrysum foliis oblongis circa caulem auritis & tomentosis* of Breyn, Prodr. 29, t.

xviii. fig. 3 (1739), this being referred by Index Kewensis to *Helichrysum crispum* D. Don, not *H. spatulatum* Moench. The plant which generally passes as *Gnaphalium spathulatum* cannot, therefore, maintain that name. The exact identity of Lamarck's type is yet to be worked out. The habit-photograph of it before me is good as such, but until the technical characters can be closely studied it would be unsafe to base a new name upon it. The group of annuals and biennials to which it belongs is most complex, a series of ruderal and campestrian plants of tropical and warm-temperate regions of which the characters reside in habit, shape and indument of leaves, indument of stem, indument of involucre, shape of phyllaries, etc. The plant usually passing as *G. spathulatum* is wide-spread in South America, and in North America from Florida to Texas, north to southeastern Pennsylvania and southern California. Superficially it strongly resembles *G. platense* Cabrera, Compuestas Bonaerenses, 167, fig. 45 (1941), but that species, as clearly illustrated by Cabrera, has the leaves and stems copiously glandular, the elongate pluricellular glands of the stem divergent, and the inner phyllaries slender-tipped. Cabrera refers *G. spathulatum* Lam. to *G. americanum* Willd., but certainly the plant of our southern states is not the West Indian *G. americanum*, which is very near *G. purpureum* L. Until the whole complex group can be most thoroughly studied, with intimate knowledge of the actual types and their technical characters, it would be quite unwise to rename the poorly understood *G. spathulatum* Lam. (originally a garden-plant). I am, therefore, at the risk of publishing a name which eventually may have to be discarded, proposing a new name based upon an unequivocal type.

Gnaphalium (§ Gamochaeta) **peregrinum,** sp. nov. (tab. 795), bienne vel annuum; caulibus subsimplicibus vel plerumque ramosis 1–6 dm. altis griseo-lanatis; foliis caulinis anguste spathulato-obovatis vel late oblanceolatis apice rotundatis, imis 2–7 cm. longis 0.8–2.5 cm. latis, subtus villoso-lanatis supra deinde viridescentibus; capitulis stramineis glomerulatis glomerulis subdistantibus spicam interruptam 1–2 cm. crassam formantibus; involucris 3–4 mm. altis basi valde lanatis; phyllariis interioribus oblongis vel spathulatis obtusis.—Roadsides, fallow fields and waste places, Florida to Texas and southern California, north, locally, to southeastern Pennsylvania; eastern South

America. TYPE: in burnt-over pine-scrub oak sandhills, north edge of Pineville, Rapides Parish, Louisiana, July 30, 1938, *D. S. & H. B. Correll*, no. 9937 (in Herb. Gray.).

G. OBTUSIFOLIUM L., var. HELLERI (Britt.) Blake. To the stations much farther east add one in BRUNSWICK COUNTY: sandy pine woods, Seward Forest, near Triplett, *Fernald & Lewis*, no. 14,514. See p. 380.

G. OBTUSIFOLIUM, var. MICRADENIUM Weath. Range extended inland to BRUNSWICK COUNTY: dry woods near Rattlesnake Creek, west of Triplett, *Fernald & Lewis*, no. 14,513. See p. 380.

(*To be continued*)

VICIA TETRASPERMA, VAR. TENUISSIMA IN AMERICA.—The common little weed, *Vicia tetrasperma* (L.) Moench, has oblong, round-tipped and merely mucronulate leaflets. The slender-leaved var. *tenuissima* Druce is beginning to appear with us. Its narrowly linear leaflets are attenuate to slender tips. I have examined specimens from Maine, Vermont, Massachusetts, New York and Oregon, all collected within the last half-century.—M. L. FERNALD.

Volume 45, no. 538, including pages 357–416 and plates 770–782, was issued 9 October, 1943.

JAN 3 1944

RHODORA

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
STUART KIMBALL HARRIS
} Associate Editors

Vol. 45. December, 1943. No. 540.

CONTENTS:

Cotype, Syntype, and other Terms referring to Type Material. *S. F. Blake.* 481

Virginian Botanizing under Restrictions (concluded). *M. L. Fernald.* 485

Further Note on the Date of Pursh's Flora. *W. T. Stearn.* 511

Lilium michiganense, L. canadense and L. superbum. *Edwin D. Hull.* 512

Edible Plants (Review). *Milton Hopkins.* 515

Trillium undulatum, forma Cleavelandicum. *M. L. Fernald.* ... 517

Quebec Stations for Scirpus Peckii. *M. L. Fernald.* 518

Errata. 518

Index to Volume 45. 519

The New England Botanical Club, Inc.

8 and 10 West King St., Lancaster, Pa.

52 Garden St., Cambridge, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of the Gray's Manual Range and regions floristically related. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) of not more than 24 pages and with 1 plate, 20 cents, numbers of more than 24 pages or with more than 1 plate at higher prices (see 3rd cover-page). Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application; volumes 35–43 can be supplied at $4.00 per volume, net, and some single numbers from them only at advanced prices (see 3rd cover-page). Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to

M. L. Fernald, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to

Ludlow Griscom, 8 W. King St., Lancaster, Pa., or, preferably, Museum of Comparative Zoology, Cambridge, Mass.

Entered as second-class matter March 9, 1929, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

INTELLIGENCER PRINTING COMPANY

Specialists in Scientific and Technical Publications

EIGHT WEST KING ST., LANCASTER, PA.

CARD-INDEX OF NEW GENERA, SPECIES AND VARIETIES OF AMERICAN PLANTS, 1885 TO DATE.

For American taxonomists and all students of American plants this is the most important supplement to the Index Kewensis. A work of reference invaluable for larger herbaria, leading libraries, academies of sciences, and other centers of botanical activity. Issued quarterly, at $22.50 per 1000 cards. Sets of the past issues can now be supplied only in negative photostats.

GRAY HERBARIUM of Harvard University,

Cambridge, Mass., U. S. A.

MEMOIRS OF THE GRAY HERBARIUM. A series of illustrated quarto papers issued at irregular intervals, sold separately.

No. III. The Linear-leaved North American Species of Potamogeton, Section Axillares, by M. L. Fernald. 183 pp., 40 plates, 31 maps. 1932. $3.00.

No. IV. The Myrtaceous Genus Syzygium Gaertner in Borneo, by E. D. Merrill and L. M. Perry. 68 pp. 1939. $1.50.

Gray Herbarium of Harvard University, Cambridge, Mass.

H pl. 796-806

Photo. B. G. Schubert.

HELENIUM AUTUMNALE: FIGS. 1 and 2, portions of TYPE, × 1, from photograph sent from *Linnean Society of London;* FIG. 3, flowering summit, × 1, of modern specimen from Ohio

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 45. **December, 1943.** **No. 540.**

COTYPE, SYNTYPE, AND OTHER TERMS REFERRING TO TYPE MATERIAL

S. F. Blake

As indicated by Joseph Ewan in a recent note in Chronica Botanica (**7:** 8–9. 1942), the term "cotype" has been wrongly used by some botanical writers to designate specimens of the type collection of a species (or other taxonomic unit) other than the actual type. The definition of "cotype" which Ewan cites from Hitchcock (Science n. s. **21:** 832. 1905), a specimen "cited with the original description in addition to the type specimen," is also incorrect on the basis of the original definition of the term and subsequent extensive usage, and seems to have led some botanists astray. The word "cotype" (written with the superfluous hyphen) was apparently first proposed in print by Oldfield Thomas in 1893 (Proc. Zool. Soc. 1893: 241–242). In this short but important paper, in which he sought to clarify terms relating to type material, he stated: "Already, as a step towards this end, the word 'co-type' has been introduced[1] for any specimen which was one of several forming the basis of the original description; but, like 'type,' it has become loosely and vaguely used for different sorts and classes of specimens, and equally needs definition and pinning down to one particular class, for which alone it should be used." He then gave these definitions (p. 242): "A *Co-type* is one of two or more specimens together forming the basis of a species, no *type* having been selected. No species would have both type and co-types, but either the former, or

[1] I believe in the first case by my colleague Mr. C. O. Waterhouse.

two or more of the latter." "A *Para-type* is a specimen belonging to the original series, but not the type, in cases where the author has himself selected a type. It should, however, be one of the specimens mentioned or enumerated in the original description." The anonymous editor of Natural Science, in an article entitled "Scientific Volapuk," altered "co-type" to "syntype" on puristic grounds (Natural Science **4:** 57. 1894). F. A. Bather (l. c. **4:** 160. 1894) and Charles Schuchert and S. S. Buckman (Ann. & Mag. Nat. Hist. VII. **16:** 103. 1905) concurred in this change, but Schuchert, in his important catalogue of type specimens of fossil invertebrates in the U. S. National Museum, published in the same year (1905), used exclusively the term cotype (Bull. U. S. Nat. Mus. **53**[1]**:** 11 (definition) and throughout the text).

The correction of "cotype" to "syntype" has sometimes been attributed to Bather, but this is incorrect; the change was made by the anonymous editor of "Natural Science." In any case, it is an unnecessary one. *Typus* is a perfectly good Latin word, derived of course from the Greek τύπος, and Thomas (or Waterhouse) was guilty of no etymological hybridization in using the form "cotype." The fact that essentially all other terms of this nature are derived from Greek words in conjunction with "type" does not affect the validity of this term. The additional fact that the word has been misused in two different ways by botanical authors is no compelling reason for abandoning it. Have we any assurance that such authors will use syntype correctly?

The nature of type material in botany differs from that in zoology in three principal respects. In general, botanists collect several or many individuals or fragments of a given species in the same spot at the same time and distribute them to herbaria under a given number. For practical purposes (except in the case, relatively very uncommon at least in vascular plants, of mixture of two or more species in collecting) these specimens are equivalent, and the citation of collectors' numbers in a monograph or an original description provides a ready means for the identification of specimens in herbaria not examined by the monographer or describer. The designation of a specimen of *Smith* 1234 in a given herbarium as the type of a new species makes that number wherever represented the type collection.

The existence of duplicate type material (isotypes: see below) is consequently very common in botany, with attendant beneficial results in taxonomy. The precise equivalent is scarcely known to zoologists, although its place is taken more or less satisfactorily by topotypes.

In the second place, when the zoologist speaks of a type (or holotype, if he uses that word) he practically always refers to a single specimen of the organism he is dealing with. When the botanist cites a type, he ordinarily refers to a sheet of mounted material (vascular plants) or a pocket containing one to many individuals of a moss, lichen, or fungus, or a mounted slide bearing one to many individuals of a microscopic form. Since a type proper (holotype) is by definition an individual specimen, it follows that the type sheet or pocket or slide, when it bears more than one individual or parts of individuals is not a holotype but a group of cotypes. Ordinarily these are conspecific, but sometimes they are not, and it then becomes necessary for some student, recognizing the true state of affairs, to select a single specimen as lectotype, or at least to clarify the case by excluding the material not belonging to the species as restricted by him. The situation then is just as it is when it becomes necessary to select a type from several specimens of different collections cited in the description of a new species by an author writing in the days before the designation of types had become established.

A third difference of considerable practical importance is found in the fact that botanical specimens, generally speaking, are metameristic in nature while zoological specimens are not, except in some of the lower forms such as bryozoa and corals. The animal specimen is an entity and cannot suffer the loss of any of its parts without irreparable damage. The plant specimen, in very many cases, bears so many flowers, fruits, and leaves that fragments can be spared for deposit in other herbaria, and these fragments showing the distinctive technical characters, particularly if accompanied by a photograph, not only make it possible for the distant monographer to make certain of the identity of the plant in question but for practical purposes multiply the type and afford a safeguard against its accidental or purposive destruction—a consideration not without significance in A. D. 1943.

Of the multitude of terms that have been proposed relating to type material, conveniently summarized by D. L. Frizzell in 1933 ("Terminology of types," American Midland Naturalist **14:** 637–668), very few are really necessary in actual practice. Frizzell lists 233 altogether (including different usages of the same term), but recommends the general use of only 10, of which one (genotype) refers to a species and not to a specimen. For ordinary botanical usage, six would seem to be sufficient, and most of these will be used but seldom.

In practice, we may expect botanical authors to use the word "type" to designate the actual physical unit of preparation with which they are dealing (a sheet bearing one or several mounted specimens, a pocket of mosses or lichens, a mounted slide of microscopic forms), leaving to subsequent students the selection of a holotype when the growth of knowledge makes this necessary; and we may hope that they will agree on the use of "isotype" for duplicate specimens of the type collection. The other terms defined below will scarcely be needed except in critical discussions.

HOLOTYPE. The single specimen (or fragment) upon which a species or other form is based. For systematic botanical work the *type* of ordinary usage is a practical although not a strict equivalent.

COTYPE. Any specimen of the author's original material (when more than one) when no type was designated. *Syntype* of some authors.

PARATYPE. Each of the specimens other than the type upon which an original description is based. *Cotype* of some botanists (incorrectly). The term "paratype" applies only to specimens actually examined by the describer; duplicates of a paratype in other herbaria would properly be designated not as paratypes, but as of the paratype collection. (The practice current among entomologists of selecting some of the specimens cited in the original description, frequently not from the type locality, for designation as "paratypes" is obviously based on a misunderstanding of the proper meaning of the word. All the specimens, except the type, used in preparing the original description become paratypes automatically.)

ISOTYPE. Any specimen of the type collection other than the actual type. This term, introduced by F. W. Pennell in 1919 (Torreya **19:** 13) is omitted from Frizzell's paper, although he gives the same word as used by Gill in 1881 in a zoogeographical sense. Specimens of the type collection actually used in the preparation of the original description (= "protolog" of Schuch-

Photo. B. G. Schubert.

HELENIUM AUTUMNALE, var. CANALICULATUM, all figs. × 1 (except FIG. 5): FIG. 1, portion of plant of Hortus Cliffortianus, courtesy of Dr. *John Ramsbottom;* FIG. 2, summit of wild specimen from Quebec; FIG. 3, portion of original plate of *H. canaliculatum;* FIGS. 4 and 5, portions of Cornut plate

Photo. B. G. Schubert.

HELENIUM AUTUMNALE, var. PARVIFLORUM, both figs. × 1: FIG. 1, portion of TYPE or ISOTYPE of H. PARVIFLORUM Nutt.; FIG. 2, summit of recent specimen from Virginia

ert and Buckman) are paratypes as well as isotypes and should be so labeled. If the type specimen is lost or unavailable an isotype is in general much more important than a paratype for the interpretation of a name.

LECTOTYPE. A holotype selected from among cotypes subsequent to the original description. It should be selected by a reviser on the basis of actual study of the original description and all the material involved in it, not mechanically on the basis of priority of position or because the name of one of the collectors was adopted for the specific name.

TOPOTYPE. A specimen from the type locality.

DIVISION OF PLANT EXPLORATION AND INTRODUCTION,
BUREAU OF PLANT INDUSTRY,
Washington, D. C.

VIRGINIAN BOTANIZING UNDER RESTRICTIONS

M. L. FERNALD

(*Continued from page 480*)

SOME VARIETIES AND SPECIES OF HELENIUM (PLATES 796–799).—As a genus *Helenium*, in its present sense, was first called *Helenia* L. Hort. Cliff. 418 (1737). It consisted of a single species, *Helenia foliis decurrentibus*, based in part on the plant of Clifford's garden (our PLATE 797, FIG. 1), in part upon many references to previously described plants of European gardens called *Heleniastrum*, *Chrysanthemum* or *Aster*, the latter not actually before Linnaeus. When the genus was taken up at the nomenclaturally critical date, 1753, and assigned a binomial it was as *Helenium autumnale* L. Sp. Pl. ii. 886 (1753). The citations then given by Linnaeus indicate the two plants somewhat generally found at that time in European gardens, and, although in N. Am. Fl. xxxvi². 127 (1915) Rydberg says that the type came from Canada, Linnaeus himself in 1753 was not so explicit, he then saying "*Habitat in* America *septentrionali*". In Hortus Cliffortianus he had said "*in* Florida & Canada".

The plant of Clifford's garden (our PLATE 797, FIG. 1) had narrowly lanceolate and long-acuminate, nearly entire leaves, few long-peduncled heads, the mature disk 1.8+ cm. broad, the narrow ligules strongly narrowed at base, 2 cm. long and only 2.5–3.3 mm. broad at the sharply trifid apex. Except that its

leaves are rather more spreading and its branching looser, it closely matches the plant of tidal shores of the St. Lawrence (FIG. 2), there found from near Montreal to below Quebec, and extending westward through much of the St. Lawrence basin and far to the southwest. Rydberg's inference was correct, apparently, that this plant originated in Canada. The second plant cultivated in Europe was the extreme which Linnaeus preserved in his own herbarium (presumably from the Upsala garden) and which, according to the late Dr. B. Daydon Jackson, was before him in preparing Species Plantarum, ed. 1. This (our PLATE 796, FIG. 1) is the coarser plant of our Northeast, with more elliptic and broader, toothed leaves, and large heads, with the mature disk of the leading head nearly 2.2 cm. broad, the flat and cuneate ligules 2.2–2.3 cm. long and 8.3–11.7 mm. broad at the bluntly lobed summit. Just such a plant (FIG. 2), with ligules up to 2.5 cm. long, occurs from western New England to Minnesota, south to New Jersey, upland to western North Carolina, Kentucky and Missouri. *Helenium autumnale* of 1753 consisted of both extremes and there is logic in interpreting either of them as the type. In a nomenclature beginning with 1753 (not 1737 and earlier), however, the plant in the Linnean Herbarium, the specimen Linnaeus definitely had before him in preparing Species Plantarum, is here selected. It is the extreme of the species which most students of the past have treated as *H. autumnale*, as will later be noted.

Both of them being in European gardens, whence they were described by Ventenat in 1720, Miller, with no reference to Linnaeus, took his cues directly from Ventenat, not from the Linnean Herbarium. Miller called *Helenium autumnale* the narrow-leaved extreme, the "*Bastard Sun-flower with a longer and narrower leaf*," the *Heleniastrum folio longiore & angustiore* of Ventenat; and the plant with broader leaves and larger heads, the *Heleniastrum folio breviore & latiore* of Ventenat, Miller called *Helenium latifolium* Mill. Gard. Dict. ed. 8 (1768), the "*Bastard Sun-flower with a broader and shorter leaf*". Among botanists of the period, however, Miller was essentially alone in his interpretation. Lamarck, Smith, Schkuhr and other botanists, far more precise than the very impressionistic Miller, took the broad-leaved and large-headed plant (our PLATE 796) of the Linnean Herbarium as

true *H. autumnale*. Thus Lamarck described as a new species, *H. canaliculatum* Lam. in Journ. d'Hist. Nat. ii. 213, t. 35 (1793) the narrow-leaved plant of European gardens which Ventenat had called *Heleniastrum folio longiore & angustiore* and which Miller took up as *H. autumnale*. Lamarck's description and life-sized illustration (our PLATE 797, FIG. 3) indicated unbranched plants with solitary large heads with ligules 1.6 cm. long and only 3–5 mm. broad at the sharply toothed summit: "Semi-flosculi 15–18, foeminei, distincti, patentes: ligulis concavo-canaliculatis, apice tridentatis". Lamarck went on "L'*Helenie canaliculée* diffère évidemment de l'*Helenie* d'automne (dict. vol. 3, pl. 81) . . . par son aspect, son port, et principalement par le caractère de ses demi-fleurons, qui ne sont point élargis, planes, et réfléchis comme dans ces [referring to both *H. autumnale* and *H. quadridentatum*] espèces"; and in summary he contrasted his *H. canaliculatum* "*semi-flosculis canaliculatis*" and *H. autumnale* "*semi-flosculis planis reflexis*". Somewhat later Lamarck, Ill. iv. t. 688, fig. 1 (1797), illustrated his conception of *H. autumnale*, the plant of the Linnean Herbarium.

Helenium canaliculatum Lam. (portion of his illustration, shown in our PLATE 797, FIG. 3) was unquestionably the same as the plant (our PLATE 797, FIG. 1) of the Clifford garden. Except for the more spreading leaves, a natural response to the ameliorations of cultivation, *H. canaliculatum* is the extreme (FIG. 2) of *H. autumnale* which characterizes the tidal shores of the St. Lawrence from above Montreal to below Quebec, thence westward to Minnesota and Iowa. That region was the source of many plants early carried to Europe and a very inexact and obviously conventionalized plate of it with similarly elongate leaves, too many heads for the wild plant, and tremendously multiplied but characteristic rays was described and illustrated as *Aster luteus alatus* by Cornut, Canadensium Plantarum, 62, 63 (1635). The life-sized head and reduced leaves from Cornut's plate are here reproduced as PLATE 797, FIGS. 4 and 5. It will be noted that its disk is 2 cm. broad, its ligules about 1.5 cm. long and 4–5 mm. broad at the sharply toothed summit. It is obviously of the same variety as the plant of the Clifford garden and as that of the Paris garden described and illustrated by Lamarck as his *H. canaliculatum*.

When Sir James Edward Smith purchased and eventually established in London the herbarium of Linnaeus he intimately knew the collection and in his many articles in Rees' Cyclopedia he clearly designated what he understood, from studying the collection and literature, as the types of many Linnean species. Thus, in Rees, Cycl. xvii. (1819), he took as *H. autumnale* the plant of the Linnean Herbarium with "*Leaves* elliptic-lanceolate, . . . more or less deeply serrated. *Flowers* large", etc., while for the plant of European gardens with "*Leaves* linear-lanceolate, entire", etc., the *H. autumnale* sensu Miller, he proposed the new name *H. longifolium* Sm. In treating as typical *Helenium autumnale* the plant which Lamarck had already (1793) selected and which he soon (1797) illustrated I am not only following the very careful Lamarck and Smith but am trying to keep the concept which has prevailed among most botanists until Rydberg. Witness, besides the illustration by Lamarck and the treatment by Smith, the following illustrations of *H. autumnale:* Schkuhr, Bot. Handb. ed. 2, t. 250a (1808); Barton, Fl. N. Am. i. t. 26 (1821); Raf. Med. Fl. i. t. 47 (1828); Hook. in Bot. Mag. lvii. t. 2999 (1830); Meehan, Fl. and Fern U. S. ii. t. 29 (1879); and so on to Britton & Brown, Ill. Fl. iii. 450 (1898) and House, Wild Fl. N. Y. ii. t. 261 (1918). By so doing less violence is done well established and fully justified usage than by taking up for the plant of Linnaeus's own herbarium, labeled by him *H. autumnale,* the name *H. latifolium* Mill., as is done by Rydberg in the N. Am. Fl. xxxiv^{2}. 127 (1915). In there taking up as *H. autumnale* the *H. longifolium* Sm. Rydberg showed that he did not understand the latter. If he had understood it he would not have referred *H. canaliculatum* Lam. (clearly *H. autumnale* sensu Miller and *H. longifolium* Sm.) without question to the synonymy of *H. latifolium;* and if he had understood *H. autumnale* of Herb. L. and of Lamarck, Schkuhr, Smith, Barton *et al.* (*H. latifolium* Mill.) he would not have contented himself with "ligules 10–15 mm. long". In the type they are 2.3 cm. long.

Besides typical *Helenium autumnale* (*H. latifolium* Mill.) and the rather local var. *canaliculatum* (Lam.) Torr. & Gray, Fl. N. Am. ii. 284 (1842), a combination not cited in the North American Flora, we have a wide-ranging southern extreme of the species (PLATE 798), the plant with small and *narrow* rays which was

described as a species, *H. parviflorum* Nutt. Although *H. parviflorum* in most extreme variations is very different from true *H. autumnale*, their ranges overlap and it is most difficult to find any stable morphological character to keep them apart. The chief claim of *H. parviflorum* to recognition is its extension far south of the other varieties, a plant with the flowering and fruiting disk only 0.8–1.5 cm. broad (as opposed to 1.6–2.3 cm. in true *H. autumnale*), the ligules 3–12 mm. long and only 3–7 mm. broad (as opposed to 1.6–2.5 cm. long and 7–12 mm. broad in true *H. autumnale*). For six days (a full week) I have boiled out disk-florets and ligules, seeking in the *H. autumnale* complex some stable characters of disk-corollas, pappus and achenes, and, although there is extreme diversity in the number, shape and length of the pales of the pappus, sometimes short, sometimes much longer and more slender, sometimes in several lengths, and while the disk-corollas may have very short or almost obsolete tubes, or the tubes may be prolonged and the throat more campanulate, I have been quite incapable of making these divergencies fall into clear geographic patterns or associate themselves with other characters. After concentrated study for a week I get back to the decision of Torrey & Gray who wrote: "Some of our varieties are possibly species; but they accord in every thing but the pappus, which also presents every intermediate gradation. The var. β. [the western var. *grandiflorum* (Nutt.) Torr. & Gray] is the only state we have seen from Oregon, Saskatchewan, &c.: but a state with a nearly similar pappus is common in New York; while other specimens, otherwise undistinguishable, present a reduced and merely acute pappus".—Torr. & Gray, l. c. (1842). Torrey & Gray had a score or so of specimens; the ten score of specimens from which I have boiled (to clarify and straighten) the florets have failed to bring any more clarification than they could get from their hand-full of material.

Excluding the plants from west of the "Manual range", the great bulk of inclusive *Helenium autumnale* seems to me to fall into three recognizable geographic varieties:

HELENIUM AUTUMNALE L. Sp. Pl. ii. 886 (1753) in part (as to plant of Herb. L. bearing the identification of Linnaeus); Lam. in Journ. d'Hist. Nat. ii. 215 (1793) and Ill. iv. t. 688, fig. 1 (1797);

Schkuhr, Bot. Handb. ed. 2, t. 250a (1808); Smith in Rees, Cycl. xvii (1819); Barton, Fl. N. Am. i. t. 26 (1821); Raf. Med. Fl. i. t. 47 (1828); Hook. in Bot. Mag. lvii. t. 2999 (1830); Torr. & Gray, Fl. N. Am. ii. 384 (1842); Meehan, Fl. and Ferns U. S. ii. t. 29 (1879); Britton & Brown, Ill. Fl. iii. 450 (1898); House, Wild Fl. N. Y. ii. t. 261 (1918). *H. latifolium* Mill. Gard. Dict. ed. 8, *Helenium* no. 2 (1768); Rydb. in N. Am. Fl. xxxiv². 127 (1915) as to plant, not as to most citations. *Helenia autumnalis* Hill, Hort. Kew. 6 (1769). *Helenium pumilum* Willd. Enum. Suppl. 60 (1813). *H. altissimum* Link ex Rydberg l. c. 126 (1915).—Stem 0.5–1.5 m. high, wing-angled, simple or branching, corymbose-branched at summit; leaves elliptic, oblong or lanceolate, acuminate, membranaceous, the larger coarsely dentate ones 0.5–1.6 dm. long and 2–5.5 cm. broad; heads few-many, peduncled, in terminal corymb; fully developed disk 1.6–2.3 cm. broad; ligules flat, cuneate, deep yellow, soon reflexed, 1.6–2.5 cm. long, 7–12 mm. broad at the bluntly toothed or lobed summit; pappus much shorter than to two thirds as long as disk-corolla.—Rich thickets, meadows and shores, western New England to Minnesota, south to New Jersey, western North Carolina, Kentucky and Missouri, northward passing into var. *canaliculatum*, southward into var. *parviflorum*. A few fairly typical specimens are the following. MASSACHUSETTS: Stockbridge, September 5, 1912, *R. Hoffmann;* Sheffield, September 30, 1919, *Churchill.* CONNECTICUT: Hartford, September 15, 1882, *Chas. Wright;* East Haven, October 7, 1902, *Woodward.* NEW YORK: Canton, *Phelps*, no. 1001; South Bay, Madison County, *House*, no. 10,815; Sylvan Beach, Oneida Co., *House*, nos. 2843 and 8705; Dryden, *MacDaniels & Eames*, no. 1313. NEW JERSEY: Fieldsboro, *Long*, no. 18,221; southwest of Harrisonville, *Long*, no. 45,269. PENNSYLVANIA: Washington Crossing, Bucks County, September 25, 1923, *Meredith:* Wissahickon Ravine, Philadelphia County, September 24, 1924, *Henry A. Lang;* Sayre, *Barbour*, no. 815. WEST VIRGINIA; Greenbrier River, Pocahontas County, *Greenman*, no. 534; Hendricks, Tucker County, *Greenman*, no. 536. ONTARIO: Tobermory, *Krotkov*, no. 7908 (mixed with var. *canaliculatum*). OHIO: Garrettsville, Portage County, *R. J. Webb*, no. 400. ILLINOIS: Bloomington, August, 1886, *B. L. Robinson.* Our PLATE 796.

Var. CANALICULATUM (Lam.) Torr. & Gray, Fl. N. Am. ii. 284 (1842). *H. autumnale* L. Sp. Pl. ii. 886 (1753) in part, as to some citations, not as to plant of Linnean Herb. designated by Linnaeus; Mill. Gard. Dict. ed. 8 (1768); Rydb. in N. Am. Fl. xxiv². 127 (1915). *H. pubescens* Ait. Hort. Kew. iii. 227 (1789). *H. canaliculatum* Lam. in Journ. d'Hist. Nat. ii. 213, t. 35 (1793). *Halenie decurrens* Moench, Meth. 589 (1794), both as to description and citation only of the Morison figure which is of most

characteristic *H. canaliculatum*, and obviously copied from Cornut. *Helenium longifolium* Sm. in Rees, Cycl. xvii, *Helenium* no. 2 (1819). *H. autumnale pubescens* (Ait.) Britton in Mem. Torr. Bot. Cl. v. 339 (1894).—Stem relatively slender, 3.7–9 dm. high with 1–many heads; leaves linear to lanceolate, entire or shallowly denticulate, firm, subrigid, the larger ones 3–12 cm. long and 3–18 mm. broad; mature disk 1–2 cm. broad, ligules strongly narrowed and often convolute at base, 1–2 cm. long, and 2–7 mm. broad at the shallowly and sharply to bluntly toothed summit.—Estuary of the St. Lawrence River, Quebec, west to Minnesota and Nebraska, south to Massachusetts (adventive), New York and northern Ohio, Indiana, Illinois, Missouri, Texas and Arizona.[1] Some characteristic specimens are as follows: QUEBEC: Cap Rouge, *Victorin*, no. 28,177; St. Vallier, *Svenson & Fassett*, no. 3022; Berthier, Montmagny County, *Fernald & Pease*, no. 25,324; Longueuil, *Victorin*, no. 18,376; Boucherville, *Victorin*, no. 27,574. MASSACHUSETTS: Clam Shell Bluff, Concord, September 9, 1934, *R. J. Eaton* (adventive, leaves more toothed than in most material). NEW YORK: Canton, *Phelps*, no. 1002; Springport, *Eames & Wiegand*, no. 11,007. ONTARIO: Tobermory, *Krotkov*, no. 7908 (mixed with typical *H. autumnale*); Birch Island, Lake Huron, *Macoun*, no. 26,508 (distributed as *H. huronense* Britton, an herbarium-name unfortunately published in synonymy, therefore with no status, by Rydberg in N. Am. Fl. xxxiv[2]. 127 (1915)). OHIO: Windham Township, Portage County, *R. J. Webb*, no. 5554. WISCONSIN: St. Croix Falls, August 20, 1900, *C. F. Baker;* La Crosse, *Pammel*. ILLINOIS: Aurora, September, 1882, *T. E. Boyce;* Urbana, *Pease*, no. 12,504. MINNESOTA: Lake City, August 15, 1883, *W. H. Manning*. IOWA: Iowa Falls, Hardin County, August, 1928, *M. E. Peck;* Redfield, Dallas County, August 27, 1867, *J. A. Allen;* Fayette, August, 1894, *Fink*. NEBRASKA: Beaver Creek, Holt Co., *Fred Clements*, no. 2858; South Fork of Dismal River, *Rydberg*, no. 1690. MISSOURI: Dodson, *Bush*, no. 4148, distrib. as *H. montanum;* Columbia, Boone Co., *Lisle Jeffrey*, no. 261. KANSAS: Chautauqua Co., *Hitchcock*, no. 737. TEXAS: banks of streamlets about Friedrichsburg, *Lindheimer*, no. 477. ARIZONA: cañon at Fort

[1] **Passing westward, from Saskatchewan and North Dakota to eastern Washington, south to New Mexico, into the shorter- and broader-leaved**

Var. montanum (Nutt.), **stat. nov.** ***H. montanum*** **Nutt. in Trans. Am. Phil. Soc. n. s. vii. 384 (1841).**

For note on *H. autumnale pubescens* (Ait.) Britton see p. 492. It is probable that Aiton had the two plants which were in general cultivation in Europe, not the western var. *montanum* to which Rydberg doubtfully refers var. *pubescens*.

Farther west, in British Columbia, Washington and Oregon, becoming the large-flowered

Var. GRANDIFLORUM (Nutt.) Torr. & Gray, Fl. N. Am. ii. 384 (1842); Gray, Syn. Fl. N. Am. i[2]. 349 (1884); independently published by Howell, Fl. Nw. Am. 359 (1900). ***H. grandiflorum*** **Nutt. l. c. (1841).**

Huachuca, *Lemmon*, no. 2776. Plate 797.—Many specimens transitional to the preceding and the following, and on the Plains of the West to var. *montanum*.

Aiton, Hort. Kew. iii. 227 (1789), had a *H. pubescens*, described simply "H. foliis pubescentibus". Torrey & Gray and, later, Gray treated it as synonymous with the inclusive *H. autumnale*, of which the typical variety is subglabrous, in both places wrongly citing the page as "287". In Mem. Torr. Bot. Cl. v. 339 (1894) we get the unexplained combination *H. autumnale pubescens* Britton, based upon *H. pubescens* Ait. of page "287". Had the author of the new trinomial looked up Aiton, instead of copying the error of Torrey & Gray and of Gray, he would have noted that *H. pubescens* was on p. 227. I have not seen Aiton's type; neither had Britton. From the date (1789) it is probably var. *canaliculatum*.

*Var. **parviflorum** (Nutt.) stat. nov. *H. parviflorum* Nutt. in Trans. Am. Phil. Soc. ser. 2, vii. 384 (1841).—Leaves membranaceous or submembranaceous, elliptic, oblong, lanceolate or oblanceolate, coarsely toothed to subentire, the larger ones 0.5–1.5 dm. long and 0.7–3.5 cm. broad; mature disk 0.8–1.5 cm. broad; ligules 3–12 mm. long and 3–7 mm. broad, often canaliculate below.—Bottomlands, swamps and other low grounds, Florida to Arkansas, north to Connecticut, New York, Pennsylvania, Kentucky, Illinois and southeastern Iowa, thoroughly typical and isolated southward, passing insensibly into the two preceding northward. The following, from a very large series before me, are characteristic. Connecticut: Sprague, August 9, 1900, *Woodward;* Selden Cove, Lyme, August 29, 1901, *Bissell;* Stratford, August 16, 1895, *Eames.* New York: old specimens without designated locality, *Torr. & Gray, Fl.* New Jersey: east of Silverton, Ocean County, *Fogg*, no. 4901 (narrowest-leaved extreme); Mays Landing, August 28, 1910, *W. Stone;* Cold Spring, *Fogg*, no. 235; Treasure Island, Hunterdon County, *Long*, no. 38,291. Pennsylvania: Delaware County, 1861, *Canby*, called by Gray *H. parviflorum*, with the later comment "Passes for but ??", the material (relatively thin-leaved) marked by Rydberg as *H. longifolium* Sm., i. e. *H. autumnale* var. *canaliculatum;* Dillerville Swamp, Lancaster County, September 18, 1889, *Heller.* Delaware: Bayville, Sussex County, *Fogg*, no. 11,271; north of Leipsic, Kent County, *Fogg*, no. 6230. West Virginia: Roland Park, Cabell County, *Gilbert*, no. 546. Virginia: Hunting Creek, southwest of Alexandria, *G. H. Shull*, no. 188; Bedford County, September, 1873, *A. H. Curtiss;* Jamestown Island, James City County, *Fernald &*

Photo. B. G. Schubert.

HELENIUM GODFREYI: FIG. 1, TYPE, × ½; FIG. 2, achene, × 10
H. FLORIDANUM: FIG. 3, portion of TYPE, × 1; FIG. 4, achene, × 10
H. NUDIFLORUM: FIG. 5, achene, × 10

Photo. B. G. Schubert.

SENECIO AUREUS: FIG. 1, portions of TYPE, × 1, from photograph sent from *Linnean Society of London;* FIG. 2, achene, × 10, from Virginia
S. TOMENTOSUS: achene, × 10, from Virginia

Long, no. 11,204; Kittewan Creek, Weyanoke, Charles City County, *Fernald & Long*, no. 11,483; near Creeds, Princess Anne County, *Fernald, Long & Fogg*, no. 5139; Northwest, Norfolk County, *Fernald & Long*, no. 14,068; northwest of Suffolk, *Fernald & Long*, no. 13,833; Factory Hill, Nansemond County, *Fernald & Long*, no. 4914; south of South Quay, Nansemond County, *Fernald & Long*, no. 11,482; southeast of Burgess, Dinwiddie County, *Fernald & Long*, no. 7713; southeast of Stony Creek, Sussex County, *Fernald & Long*, no. 13,832; Meherrin River, south of Edgerton, Brunswick County, *Fernald & Lewis*, nos. 14,515 (leaves short, broad and sparsely toothed) and 14,516 (leaves narrower and sharply and copiously toothed). North Carolina: near Hillsboro, Columbus County, *Godfrey*, no. 6278; north of Burgaw, Pender County, *Godfrey*, no. 6537; near Sunford, Lee County, *Godfrey*, no. 6911; Winston-Salem, *Godfrey*, no. 6094; Sylva, Jackson County, September 18, 1897, *E. E. Magee*. South Carolina: near Georgetown, *Godfrey & Tryon*, no. 8240. Georgia: Macon, September 3, 1883, *J. D. Smith;* Warsaw, Long County, *Eyles*, no. 7655. Florida: St. Mark's, Wakulla County, *Nash*, no. 2534; Apalachicola, *Biltmore Herb.*, no. 515a. Kentucky: near Wasioto, Bell County, *Kearney*, no. 506. Tennessee: Knoxville, *W. A. Anderson*, no. 638; Townsend, September 26, 1936, *Luther Burns*. Alabama: without stated locality, *Nuttall* (possible type or isotype of *H. parviflorum* —bearing Nuttall's asterisk and entirely agreeing with his description, although as noted by Gray, Syn. Fl. i^2. 349, Nuttall cited it as from Georgia); on Bogue Chitto, Perry County, September 1, 1885, *J. D. Smith;* near Marion, Perry County, September 2, 1885, *J. D. Smith;* Auburn, Lee County, *Earle & Earle*, no. 89. Mississippi: Taylorville, *Tracy*, no. 8529; Jackson, September 6, 1885, *J. D. Smith*. Illinois: Champaign, *Pease*, no. 12,389; Peoria, September, 1904, *F. E. MacDonald*. Iowa: Keosauqua, *Pammel & Reis*, no. 465. Missouri: Bakersfield, Ozark County, *E. J. Palmer*, no. 32,829; Greenwood, *Bush*, no. 4134; Noel, *Bush*, nos. 5265 and 5270. Plate 798.

In the plastic group with disk globose or globose-ovoid and usually brown or purplish, the receptacle ovoid and the ray-flowers sterile or neutral, Rydberg treats both *Helenium nudiflorum* Nutt. and *H. polyphyllum* Small as good species. Only by recognizing the smallest specimens with narrowest cauline wings as the former, the largest ones with broadest wings as the latter, ignoring the large series of transitional specimens can one do so. The intermediate pile is altogether too large; but in our Southeast there are two extremes, native of low woods and swamps and evidently local endemics, which seem to be really

well defined species. In typical campestrian and aggressively weedy *H. nudiflorum* (including *H. polyphyllum*) the pales of the pappus are narrowly lanceolate to lance-ovate and 0.5–1.6 mm. long, the pales attenuate to narrow tips or scabrous awns, the firm and usually scabridulous cauline leaves linear to narrowly lanceolate or oblanceolate. In southeastern South Carolina, however, there is a plant of this series, occurring in low woods or in wooded bottomlands, with membranaceous and quite smooth cauline leaves lance- to elliptic-oblong, the pappus of blunt and awnless round or oval small pales. This I am calling

H. **Godfreyi,** sp. nov. (TAB. 799, FIG. 1 et 2), *H. nudifloro* habitu simillima; foliis caulinis membranaceis laevibus lanceolato-vel elliptico-oblongis; achaeniis glabris verrucosis, pappi paleis albidis suborbicularibus vel ovalibus muticis 0.4–1.4 mm. longis.—SOUTH CAROLINA: creek-bottom through rich lowland-woods, 4 miles west of Georgetown, June 27, 1939, *Godfrey & Tryon*, no. 124; cleared strip along logging railroad through floodplain-forest, Santee River, 3 miles northeast of Pineville, Berkeley County, July 14, 1939, *Godfrey & Tryon*, no. 586 (TYPE in Herb. Gray.).

This localized species is named for ROBERT KENNETH GODFREY whose extensive field-work is greatly clarifying our knowledge of Carolina plants.

Another relative of *Helenium nudiflorum* is concentrated in the northern half of Florida. In this plant the relatively small heads are either rayless or with well developed ligules, but the ovate pappus-pales (1–1.6 mm. long) are rounded at tip and terminated by a very long, filiform and smoothish awn. This plant seems worthy of recognition as

H. **floridanum,** sp. nov. (TAB. 799, FIG. 3 et 4), capitulis valde corymbosis radiatis vel eradiatis; pappi paleis 1–1.6 mm. longis ovatis apice rotundatis abrupte aristatis, aristis filiformibus laevibus.—FLORIDA: moist ground near Jacksonville, May 28, 1891, *Curtiss*, no. 4972; low grounds, Duval County, July, *Curtiss*, no. 1520; hummock-land, Eustis, Lake County, April 15–30, 1894, *Nash*, no. 550; around ponds in pine woods, Sumter County, June 5, *Curtiss*, no. 11; low open woods near Fitzgerald, Hernando County, June 14, 1900, *Curtiss*, no. 6663 (TYPE in Herb. Gray., distributed by Curtiss with an unpublished varietal name and with the note: "Uniformly without rays along the Withlacoochee River"); waste ground in Tampa, June 1, 1886, *Curtiss*, no. 12.

PLATE 796 is of HELENIUM AUTUMNALE L., × 1: FIGS. 1 and 2, portions of TYPE in Linnean Herb., original photograph through kindness of Mr. *S. Savage;* FIG. 2, summit of plant from Garrettsville, Portage County, Ohio, *R. J. Webb*, NO. 400.

PLATE 797, H. AUTUMNALE, VAR. CANALICULATUM (Lam.) Torr. & Gray, × 1, except FIG. 5: FIG. 1, portion of *Helenia foliis decurrentibus*, etc. of Hortus Cliffortianus, courtesy of Dr. *John Ramsbottom;* FIG. 2, summit of plant from River St. Lawrence, Berthier, Montmagny County, Quebec, *Fernald & Pease*, no. 25,324; FIG. 3, portion of original plate of *H. canaliculatum* Lam.; FIGS. 4 and 5, portions of illustration of *Aster luteus alatus* of Cornut, Canad. Pl. (1635).

PLATE 798, H. AUTUMNALE, VAR. PARVIFLORUM (Nutt.) Fern., × 1: FIG. 1, portion of TYPE or ISOTYPE of *H. parviflorum* Nutt.; FIG. 2, summit of plant from south of South Quay, Nansemond County, Virginia, *Fernald & Long*, no. 11,482.

PLATE 799, FIGS. 1 and 2, H. GODFREYI, n. sp.: FIG. 1, TYPE, × ½; FIG. 2, achene, × 10. FIGS. 3 and 4, H. FLORIDANUM, n. sp.: FIG. 3, fragment of TYPE, × 1; FIG. 4, achene, × 10. FIG. 5, achene, × 10, of H. NUDIFLORUM Nutt., from Emporia, Virginia, *Fernald & Long*, no. 10,451.

SENECIO AUREUS AND ITS GEOGRAPHIC VARIETIES AND ALLIES IN EASTERN NORTH AMERICA (PLATES 800–806)—To one who from boyhood has known as *Senecio aureus* the common glabrous or promptly glabrate plant of peaty meadows, swales and swampy thickets of New England, New York and Pennsylvania, with suborbicular to round-ovate obtusely crenate radical leaves which are tufted from very slender and cord-like elongate rhizomes and basal offshoots, it is very disconcerting on every trip to tidewater Virginia to see as a dominating plant of calcareous woods and fertile bottomland, never in meadows and boggy places, a coarser plant with stout almost finger-like purple basal offshoots, very large heads and, when young, a copious long tomentum at the bases of the petioles, on the unexpanded leaf-surfaces and over the unexpanded corymb, and to be obliged to call it also *S. aureus.* So different is this southern plant of rich woods from the common plant of swamp and swale northward that it, again, comes as a surprise to find that it is true *S. aureus* L. Sp. Pl. ii. 870 (1753). Linnaeus based the species primarily upon the Clayton collection, nos. 249 and 286, from Virginia, described by Gronovius, with a second reference to the *Jacobaea virginiana* of Morison and of Ray. The Clayton plant, which is the TYPE (our PLATE 800, FIG. 1) is very characteristic material of the woodland species of eastern Virginia, and phrases in the account by Gronovius but not quoted by Linnaeus are peculiarly significant to one who knows the southern plant, "leviter superne lanatis, radice parva atro-rubente", for the woodland plant of tidewater Virginia is

very striking on account of the purple or dark red stiff rhizomes and basal offshoots and the lanate tomentum of the unexpanded corymb. "Madidis & umbrosis gaudet" of the Clayton account is also wholly satisfactory. So is the contradiction between the brief italicised diagnosis of Gronovius with "*foliis crenatis*" and the fuller account below "foliis infimis rotundis ad marginem serratis", for the type shows the margin serrate-dentate or with somewhat emarginate-truncate teeth as in some of the southern specimens, while the phrase "foliis crenatis", taken over by Linnaeus, fits other specimens.

Since the common plant of the northeastern states differs in several characters from typical southern *Senecio aureus*, standing midway between it and var. *gracilis* (Pursh) Wood, and since the more northern membranous-leaved plant (of Newfoundland, Anticosti, Gaspé, northern New England, etc.) which has erroneously passed as the Cordilleran *S. pseudaureus* Rydb., needs clarification, I am here summarizing my interpretaion of the varieties of *S. aureus:*

a. Radical leaves dentate with rounded or blunt teeth....*b.*

b. Undivided basal leaves suborbicular to round-ovate, broadly rounded at summit, with a well defined cordate base.

Basal offshoots at flowering time 4–10 mm. thick, deep red or purple; margins of basal sheaths of many petioles, surfaces of unexpanded leaves and unexpanded corymbs with long dense flocculent tomentum; involucres 8–11 mm. high; disk-corollas 6–10 mm. long; achenes 3.5–4 mm. long.....*S. aureus* (typical).

Basal offshoots at flowering time 1–5 mm. thick, green to purple; margins of basal sheaths of petioles, surfaces of unexpanded leaves and unexpanded corymbs glabrous or sparsely short-tomentose and glabrescent; involucres 5–8 (–9) mm. high; disk-corollas 5–8 mm. long; achenes 2–3.5 mm. long.

Stems 3–9 dm. high, often 2 or more; rhizomes and basal offshoots mostly 2–10 cm. long; radical leaves becoming firm and subcoriaceous, the larger ones 6–15 cm. long and 3–12 cm. broad, often purplish beneath, the longer petioles 0.5–3 dm. long; involucres 5–9 mm. high.....Var. *intercursus.*

Stems slender, mostly solitary, 2–6 dm. high; basal offshoots rarely 6 cm. long; radical leaves membranaceous, 1–3.5 cm. long, 1–2.8 cm. broad, green both sides, the longer petioles 2–10 cm. long; involucre 5–7 mm. high.....Var. *gracilis.*

b. Undivided basal leaves oblong-oval, rounded to base or some of them barely subcordate, the larger blades 2–6.5 cm. long and 1.5–4.3 cm. broad, submembranaceous.....Var. *semicordatus.*

Photo. B. G. Schubert.

SENECIO AUREUS, details from modern specimens from Virginia: FIG. 1, rhizome and basal offshoot, × 1; FIG. 2, portion of full-grown basal leaf, × 1; FIG. 3, expanding young basal leaves, showing archnoid pubescence, × 2; FIG. 4, unexpanded heads, showing arachnoid pubescence, × 2; FIG. 5, involucre, × 5

Photo. B. G. Schubert.

SENECIO AUREUS, var. INTERCURSUS, all figs. from TYPE: FIG. 1, rhizome and basal offshoots, × 1; FIG. 2, basal and lower cauline leaves, × 1, FIG. 3, involucre, × 5; FIG. 4, inflorescence, × 1

a. **Radical leaves sharply serrate or dentate at least at base to acutely or subacutely lacerate, ovate or oval to rotund, deeply cordate, acute to rounded at tip, membranaceous.**
Var. ***aquilonius.***

S. AUREUS L. Sp. Pl. ii. 870 (1753). Var. *Ashei* Greenm. in Ann. Mo. Bot. Gard. xvi. 406, pl. 35 (1929).—Rather stout; stiff basal offshoots purple, 3–15 cm. long; flowering stems 3–12 dm. high; radical leaves rounded- to oblong-ovate, becoming coriaceous, in maturity up to 2.2 dm. long and 1.8 dm. broad.—Rich calcareous woods and wooded bottomlands or in upland meadows, Florida to Arkansas, north to Virginia, Kentucky and Missouri. The following are characteristic. VIRGINIA: locality not stated, "Madidis & umbrosis gaudet", *Clayton* (TYPE, photo in Gray Herb., our PLATE 800, FIG. 1); rocky bank of brook north of Hopewell Gap, western slope of Bull Run Mountain, *Allard*, no. 4540; margin of woods, east of Wattsville, Accomac County, *R. R. Tatnall*, no. 4441; damp woods, Eastville, April 21, 1935, *M. Ellyson & E. Puette;* rich woods, Great Neck, Princess Anne County, *Fernald & Griscom*, no. 4517; low woods, Cypress Swamp, north of Dendron, *Fernald, Long & Abbe*, no. 14,243; rich alluvial woods, east of Cabin Point, *Fernald & Long*, no. 7985; bottoms of rich calcareous wooded ravines west of Claremont, *Fernald & Long*, no. 12,893; sandy alluvial woods, bottomland of Powell Creek, Garyville, *Fernald & Long*, no. 7984. NORTH CAROLINA: wet, shady ground, Biltmore, *Biltm. Herb.* no. 889[a]. FLORIDA: banks of Little River, *Chapman.* TENNESSEE: Maryville, Blount County, May 8, 1937, *Godfrey;* low wooded slope along Bean's Creek, Franklin County, *Svenson*, no. 10,018. MISSOURI: along James R., south of Springfield, Greene Co., September, 1934, *Richard Smith & Lisle Jeffrey;* along Shoal Creek, southwest of Joplin, *E. J. Palmer*, no. 29,936. ARKANSAS: wet places, "N. W. Arkansas", April, 1888, *Harvey*, no. 45. See p. 361. PLATES 800, FIG. 1, and 801.

Senecio aureus in southeastern Virginia definitely crosses with *S. tomentosus* Michaux. In April, 1942, Long, Abbe and I found (see p. 361) an extensive colony growing at the upper border of bottomland-woods of Cypress Swamp near Dendron, with typical *S. aureus* in the woods, typical *S. tomentosus* in the open. The intermediate plants, some with narrow and merely round- to tapering-based radical leaves suggesting those of *S. tomentosus*, others with them broader and subcordate, all more or less tomentulose and with tomentose to glabrescent petioles, has the involucres tomentose. It is clearly *S. aureus* × *tomentosus*. Foliage-material, misidentified as *S. Crawfordii* Britton, from a wooded ravine west of Claremont, *Fernald & Long*, no.

12,892, is very similar but smoother, and its stout and elongate horizontal rhizome keeps it out of *S. Crawfordii* (see p. 506). It was a single plant growing with typical *S. aureus*, with *S. tomentosus* abundant only a few rods away. That much is clear.

In Ann. Mo. Bot. Gard. xiv. 406, pl. 35 (1929) Greenman described as *S. aureus*, var. *Ashei* a plant of western Virginia and adjacent northeastern Tennessee, there growing in moist meadows. Evidently having in mind as true *S. aureus*[1] the glabrescent plant of wide northern and continental range, the author of var. *Ashei* emphasized for the latter the distinctive characters of typical southern *S. aureus:* "foliis inferioribus longe petiolatis . . . crenato-serratis juventate utrinque albo-floccoso-tomentosis supra denique plus minusve glabratis". Evidently puzzled by the presence of tomentum on the young and unexpanded basal leaves in his var. *Ashei*, just such pubescence as occurs on the youngest basal leaves of the plant of Clayton's region (see PLATE 801, FIG. 3), and frequently on the involucre as well (see FIG. 5), Greenman surmised that this plant of the mountain-region of western Virginia and eastern Tennessee might be a hybrid of his *S. aureus* (presumably our var. *intercursus*) and the coastal plain *S. tomentosus:* "The origin of the plant is not known . . . It may be a hybrid. There are some indications that it may be a hybrid between *Senecio aureus* L. and *Senecio tomentosus* Michx. The former of these two species occurs in the valley of the South Fork of the Holston River, and the latter species is relatively common in eastern Virginia. While the habit of the new plant is like *Senecio aureus*, yet the prevailing outline of the leaves of the offshoots and those of the lower parts of the upright stem, as well as their texture and tomentose character, suggests *Senecio tomentosus*." — Greenm. l. c. 405. The type of *S. aureus* var. *Ashei* was poorly collected, showing no rhizomes, but in outline of basal leaves and cauline leaves (so far as the mashed and crumpled leaves show) the foliage looks quite like that of the TYPE of *S. aureus* and of the characteristic specimens above cited and illustrated (PLATES

[1] Among the specimens taken by Dr. Greenman to Berlin for his preliminary studies one in the Gray Herbarium of a small plant midway between vars. *gracilis* and *intercursus*, from Rhode Island, bears the pencilled memorandum: "This specimen of Thurber's corresponds very well with specimens of *S. aureus* L. in herb. Willdenow at Berlin". The Thurber specimens and specimen like it at Berlin (if not now destroyed) are very different from the Clayton type.

800, FIG. 1 and 801). Although on the coastal plain true and characteristic *S. aureus* rarely crosses with *S. tomentosus*, producing a pretty mixed progeny, some plants with horizontal rhizomes and basal offshoots of *S. aureus*, others cespitose as in *S. tomentosus*, there is no reason to imagine that the cespitose, heavily and permanently tomentose *S. tomentosus*, with its narrow and noncordate radical leaves, its undivided or but shallowly toothed cauline leaves, its columnar and heavily hirtellous drab achenes (PLATE 800, FIG. 3) with prominent rounded ridges—there is no reason to imagine that such a plant, restricted to sterile soils of the Coastal Plain and adjacent provinces, had anything to do with the origin of the continental and upland species of rich or calcareous areas, with horizontal elongate rhizomes and basal offshoots, oval to orbicular and deeply cordate glabrous or glabrescent radical leaves, glabrous and deeply pinnatisect cauline ones, and glabrous, slender brown to reddish achenes (FIG. 2) without very prominent ridges. The cited stations of *S. aureus*, var. *Ashei* are more than 200 miles west of the nearest stations known for *S. tomentosus!*

Senecio aureus, var. *aurantiacus* Farwell in Am. Midl. Nat. xii. 74 (1930) is described as having red stems and "traces of floccose tomentum present throughout the plant at the flowering time". Its distinctive character, "Ligules . . . 3–4 lines long . . . , orange-red, reflexed" is one unknown to me. The description otherwise does not make clear what var. *aurantiacus* may be, in a region where many variations occur.

Var. **intercursus,** var. nov. (TAB. 802), planta glabra vel glabrata; rhizomatibus sobolibusque horizontalis 2–5 mm. crassis sobolibus plerumque 2–10 cm. longis; foliis radicalibus rotundo- vel late oblongo-ovatis cordatis, laminis glabris deinde subcoriaceis crenatis vel obtuse dentatis ad 6–15 cm. longis ad 3–13 cm. latis utrinque viridibus vel subtus purpurascentibus, petiolis longioribus 0.5–3 dm. longis; involucris glabris vel glabratis 5–9 mm. altis; disci corollis 5–8 mm. longis; achaeniis 2–3.5 mm. longis.—Meadows, boggy swales, swamps and low woods, southern Quebec to Michigan, south to Nova Scotia, New England, Pennsylvania, upland to Alabama, Kentucky and Missouri. TYPE: Tewksbury, Massachusetts, June 7, 1902, *E. F. Williams* in Gray Herb.

Var. *intercursus*, standing between the coarse, southern typical *Senecio aureus* and the smallest variety of the species, var.

gracilis (Pursh) Wood, is the plant most generally passing as typical *S. aureus*.

*Var. INTERCURSUS I have seen from Virginia only from ROANOKE COUNTY: moist woods along Back Creek, south-southeast of Starkey Post Office, *C. E. Wood, Jr.*, no. 3988. It is presumably of broader upland range.

Var. GRACILIS (Pursh) Wood, Class-Bk, 211 (1845), independently published as a new comb. by Britton in Britt. & Brown, Ill. Fl. iii. 481 (1898). *S. gracilis* Pursh, Fl. Am. Sept. ii. 529 (1814).—Meadows, swamps and bogs, Massachusetts to North Dakota (acc. to Greenman), south to North Carolina and Arkansas.

Var. SEMICORDATUS (Mackenzie & Bush) Greenm. in Ann. Mo. Bot. Gard. iii. 129 (1916). *S. semicordatus* Mackenz. & Bush in Mo. Bot. Gard. Ann. Rep. xvi. 107 (1905). *S. aureus* × *Balsamitae* Greenm. in RHODORA, x. 69 (1908).—Calcareous thickets, shores, meadows, etc., locally abundant, western Newfoundland; Gaspé Peninsula, Quebec, to southern Ontario, south to northern New Brunswick, Eastern Townships, Quebec, northern Ohio, Illinois and Missouri.

S. AUREUS L., var. **aquilonius,** var. nov. (TAB. 803), planta valde rhizomatosa, rhizomatibus gracilibus valde horizontaliterque elongatis (ad 3 dm. longis); foliis basilaribus membranaceis ovatis vel ovalibus vel rotundis serratis vel acute vel subacute incisis ad basin valde cordatis; foliis caulinis membranaceis basi pinnatifidis.—Newfoundland and Côte Nord and Anticosti Island, Quebec, to Algoma District, Ontario, south to Cape Breton, Prince Edward Island, northern New Brunswick, northern New England, northern New York, northwestern Pennsylvania, northern Ohio, northern Indiana and Wisconsin. Many specimens previously misidentified with the western *S. pseudaureus* Rydb. The following, selected from a very large series, are characteristic. NEWFOUNDLAND: brookside, Grand Falls, July 3, 1911, *Fernald & Wiegand*, no. 6398; park-like openings in damp mossy woods on the Silurian hills back of Birchy Cove (Curling), July 5, 1910, *Fernald & Wiegand*, no. 4174; spruce woods and thickets, slope of Lookout Mountain, Bonne Bay, *Fernald, Long & Fogg*, no. 2145; brooksides and damp bushy ravines on the limestone tableland, alt. 200–300 m., Table Mountain, Port à Port Bay, July 16 and 17, *Fernald & St. John*, no. 10,872; damp openings in woods near Overfall Camp, Great Codroy River, July 7, 1939, *Pease & Edgerton*. QUEBEC: dans les bois claire près de la rivière, Rivière de Rénard, Anticosti, 5 août 1927, *Victorin & Rolland*, no. 27,645; dans les bois de Conifères, R. Vaureal, Anticosti, 12 août 1927, *Victorin & Rolland*, nos. 27,640 and 27,641; mossy Arbor Vitae woods east

Photo. B. G. Schubert.

SENECIO AUREUS, var. AQUILONIUS, all figs. × 1, from TYPE: FIG. 1, elongate rhizome and basal offshoot; FIG. 2, basal leaves; FIG. 3, cauline leaves; FIG. 4, inflorescence

Photo. B. G. Schubert.

SENECIO PAUPERCULUS: FIG. 1, TYPE, × ¾, from photograph by *M. L. Fernald;* FIGS. 2–4, unusually tall plants, × 1, from Newfoundland

of Grande Coupe, Percé, August 6, 1907, *Fernald & Collins*, no. 1208; springy meadows in woods at 600 m. altitude, North Fork of Madeleine River, Gaspé County, July 31, 1923, *Fernald, Dodge & Smith*, no. 26,096; calcareous alpine meadows, alt. 1000–1125 m., Table-top Mountain, August 7, 1906, *Fernald & Collins*, no. 260; coniferous forest, "Low's Trail" from the Forks of the R. Ste. Anne des Monts to Table-topped Mountain, July 31 and August 14, 1906, *Fernald & Collins*, nos. 765, 766 (TYPE in Herb. Gray), 767; wet alluvial shores, between Baldé and the Baie des Chaleurs, Bonaventure River, August 5–8, 1904, *Collins, Fernald & Pease;* gravel-beaches and bars between the Forks and Brulé Brook, Little Cascapedia River, July 29 and 30, 1904, *Collins, Fernald & Pease* (*Pease*, no. 5022); slaty bank, Restigouche River, July 24–25, 1929, *Rousseau & Bonin*, no. 32,211. NOVA SCOTIA: Barrasois R., Cape Breton, *Nichols*, no. 852. PRINCE EDWARD ISLAND: swampy *Larix* and *Thuja* woods, Tignish, *Fernald, Long & St. John*, no. 8245. MAINE: wet thicket, Limestone, June 22, 1898, *Fernald;* arbor-vitae swamp, Presque Isle, July 12, 1902, *Williams, Collins & Fernald;* cedar-swamps and clearings, Blaine, June 23, 1898, *Fernald* no. 2404; damp thicket, Patten, August 23, 1897, *Fernald;* wet open woods, Roque Bluffs, July 23, 1914, *C. H. Knowlton;* meadow near Half-moon Stream, Unity, June 16, 1935, *G. B. Rossbach*, no. 926; wet ground, open woods, Clinton, July 8, 1909, *R. C. Bean;* South Poland, 1895, *Kate Furbish*. NEW HAMPSHIRE: damp shady roadside between First and Second Lakes, Pittsburg, July 6, 1907, *A. H. Moore*, no. 3523, *Pease*, no. 10,316; wet place in woods, Hill, August 29, 1933, *Chas. Bullard;* rich woods, Durham, June 21, 1939, *Hodgdon*, no. 4034. NEW YORK: Oneida, May 15, 1918, *House*. PENNSYLVANIA: Corry, May 7, 1896, *J. R. Churchill*. ONTARIO: black-ash swamp, Sault Ste. Marie, July 18, 1935, *Taylor et al.*, no. 1687. OHIO: Garrettsville, Portage County, *Webb*, no. 202. MICHIGAN: tamarack swamp, south of Ann Arbor, May 8, 1898, *S. H. Burnham;* Port Huron, May 18, 1896, *C. K. Dodge*. INDIANA: along a brook, Otis, May 20, 1911, *Sherff*. WISCONSIN: Brown County, June 11, 1900, *Schuette*.

Senecio aureus, var. *aquilonius* is the northeastern plant which has recently been passing in my own work and that of others as *S. pseudaureus* Rydb. It certainly strongly suggests the plant of the Cordilleran region in the texture and toothing of its basal leaves and the tendency to laceration and enlargement of the lower cauline blades. *S. pseudaureus*, however, has a stout and relatively short rhizome which usually forks into a tuft of crowded ascending crowns; its basal leaves tend to be oblong-ovate as in

S. aureus, var. *semicordatus* (Mackenz. & Bush) Greenm. and only slightly, if at all, more cordate, though sometimes broader, on thickish petioles 1–10 (rarely –23) cm. long; its pale-flowered heads are on pedicels 1–5 (rarely –9) cm. long. *S. aureus*, var. *aquilonius* stands off from it through its slender and horizontally creeping rhizome (up to 3 dm. long), with scattered ascending branches and tufts of leaves or flowering stems; it thus belongs with *S. aureus* var. *intercursus* and passes into it. Its basal leaves are ovate to oval or even orbicular, deeply cordate, on filiform petioles mostly 0.5–2.5 dm. long; and its deep yellow-flowered heads are on filiform pedicels mostly 3–12 cm. long.

S. AUREUS, VAR. AQUILONIUS, forma **ecoronatus** (Fernald) comb. nov. *S. pseudaureus*, forma *ecoronatus* Fernald in RHODORA, XXX. 225 (1928).

S. PAUPERCULUS Michx., forma **inornatus,** f. nov., foliis basilaribus indivisis angusto oblanceolatis laminis 1.5–2.3 cm. longis 0.5–0.7 cm. latis; foliis caulinis valde reductis majoribus 1.5–3.5 cm. longis 2–5 mm. latis; phyllariis[1] lineari-attenuatis; floribus discoideis, ligulis nullis.—MICHIGAN: limestone pavement, Seul Choix School, Schoolcraft County, July 12, 1935, *Pease & Ogden*, no. 24,946 (TYPE in Herb. Gray.). ALASKA: Miller House, on Steese Highway, 115 miles north of Fairbanks, elevation 2100 feet, July 12–18, 1940, *Edith Scamman*; no. 2166.

Not to be confused with *Senecio pauperculus*, forma *verecundus* Fern. in RHODORA, XXX. 225 (1928), of Anticosti, a plant which has all the technical characters of *S. gaspensis* Greenm., to which it must be transferred.

S. PAUPERCULUS Michx., var. **neoscoticus,** var. nov. (TAB. 806), planta 1–4 dm. alta; foliis basilaribus indivisis 1.5–6.5 cm. longis 1–2 cm. latis; foliis caulinis imis plus minusve pinnatifidis 3.5–6.5 cm. longis 0.7–2 cm. latis; capitulis 2–25, longe pedicellatis; involucris 4–5 mm. altis basin versus persistenter tomentosis; achaeniis glabris 2 mm. longis.—NOVA SCOTIA: talus of gypsum cliffs, Five-mile River, Hants County, July 19, 1920, *Pease & Long*, no. 22,914 (TYPE in Herb. Gray.), distrib, as var. *Balsamitae* (Muhl.) Fern.; common on gypsum, Antigonish Harbour, July 11, 1941, *A. E. Roland*, no. 41,741, distrib. as var. *Balsa-*

[1] NOTE ON THE TERM PHYLLARY.—The term PHYLLARY, now largely used instead of involucral bract, is given by Jackson, Gloss. Bot. Terms, as coming from a Latin word "*phyllaris*", with the result that those of us who have depended upon Jackson have, naturally, made an ablative plural "phyllaribus". Bentham & Hooker and other English phytographers had used the term as later defined in the Century Dictionary and as originally adopted in this country by Blake, from the New Latin PHYLLARIUM. This is preferred to Jackson's nominative.

mitae; rock-faces and crevices of gypsum cliffs, Port Bevis, Victoria County, August 27, 1920, *Fernald & Long*, no. 22,915, also distrib. as var. *Balsamitae*. QUEBEC: gravelly bank near Percé, Gaspé County, July 14, 1928, *Pease*, no. 20,177.

Var. *neoscoticus* is the only variation of the plastic *Senecio pauperculus* (PLATE 804) known to me from Nova Scotia. It superficially resembles var. *Balsamitae* (PLATE 805) in having well developed lower cauline leaves, but it is unlike any of the other varieties of the species in having densely and permanently tomentose involucres, in the TYPE the tomentum at the base of the involucre or, in some plants, extending to the tips of the phyllaries. The conventional and not too convincing distinction between *S. plattensis* Nutt. (1841) and *S. pauperculus* Michx. (1803) is the occurrence somewhere on the former (on stem, petioles, pedicels or involucre or on two or more of the areas at the same time) of more or less persistent tomentum, while *S. pauperculus* is glabrate or merely with flocculent tufts of tomentum. Furthermore, to quote Greenman, the former species has "achenes usually hispidulous along the angles, sometimes glabrous". In *S. pauperculus* we get "achenes glabrous or hirtellous along the angles". That leaves mighty little which seems specific. Nevertheless, of many scores of mature collections of *S. plattensis* which I have studied essentially all have hispidulous achenes. Of more than 200 members of the inclusive *S. pauperculus* examined all but 3 numbers have shown glabrous achenes. I am not ready to reduce *S. plattensis*, without field-acquaintance with it. But in its densely tomentose involucre *S. pauperculus*, var. *neoscoticus* might be looked upon as a connecting link. In all other characters, however, it is good *S. pauperculus*.

A southeastern variety, *Senecio pauperculus*, var. *praelongus* (Greenm.) House, found from eastern Massachusetts to Michigan, south to Connecticut, Maryland and the upland of Virginia, is strikingly similar to and has often been mistaken for the ubiquitous southern *S. Smallii* Britton. In New England, New York and Michigan it passes into *S. pauperculus* var. *Balsamitae*, while in the elongate cauline and basal leaves and the numerous heads it looks like *S. Smallii*. The latter, however, usually has copiously hispidulous achenes only 1.5–2.2 mm. long, the former glabrous achenes 2–2.5 mm. long. There seems to be a recog-

nizable difference in the phyllaries. In *S. pauperculus* they are linear-attenuate, gradually tapering from the base; in *S. Smallii* they are more definitely linear-oblong, with parallel sides, and tapering only toward the summit. In typical *S. pauperculus* and its var. *Balsamitae* (Muhl.) Fern., furthermore, the more or less elongate rhizome is commonly prostrate, with decumbent branches. In *S. Smallii* the short rhizome has crowded erect crowns. The photograph of the TYPE of *S. Balsamitae* Muhl. ex Willd. sent me by Professor Diels is of the northern few-leaved plant. I am clinging to these characters for what they may be worth.

Far to the northeast there is a series of plants of this affinity, growing from western Newfoundland to Anticosti, thence to northern Maine, which differs from *Senecio pauperculus* in usually broader and heavier foliage, the basal leaves tending to be elliptic or oval but sometimes oblanceolate, the disk very broad. These are the two extremes which were described as *S. gaspensis* Greenm. in Ann. Mo. Bot. Gard. iii. 138 (1916) and as *S. Balsamitae* var. *firmifolius* Greemn. in RHODORA, vii. 244 (1905) or *S. pauperculus* var. *firmifolius* (Greenm.) Greenm. in Ann. Mo. Bot. Gard. iii. 166 (1916). In their extremes the two are very different, but some of the larger specimens cited by Greenman as var. *firmifolius* are inseparable from smaller ones determined or cited by him under *S. gaspensis*. Typical *S. gaspensis* differs still further from *S. pauperculus* in having the undivided basal leaves broader (1.5–4.5 cm. broad, the basal leaves of *S. pauperculus* ranging from 0.5–2 cm. broad). Furthermore, in both typical *S. gaspensis* and in *S. pauperculus* var. *firmifolius* the phyllaries are linear-oblong, with parallel (instead of gradually converging) sides, tapering only near the tip. This apparently fairly definite species also includes the discoid form of Anticosti which, before I had spent two weeks upon the group, I placed under *S. pauperculus*. As I understand the plants I should now treat them as follows.

S. GASPENSIS Greenman in Ann. Mo. Bot. Gard. iii. 188 (1916). Stem 2–6 dm. high; undivided basal leaves with the larger blades 3.5–8 cm. long and 1.5–4.5 cm. broad; flowering stem very leafy; larger cauline leaves 5–12 cm. long, 1–3 cm. broad, chiefly pinnatifid only below the middle; pedicels mostly 2–10 cm. long; glabrous achenes 2.5–3 mm. long.—Bottomlands, damp shores,

Photo. B. G. Schubert.

SENECIO PAUPERCULUS, var. BALSAMITAE: FIG. 1, type of S. BALSAMATAE Muhl., × 1, kindness of Professor *Ludwig Diels;* FIGS. 2, 3 and 4, portions of a modern specimen from type-region, × 1; FIG. 5, involucre, × 5, from latter specimen

Photo. B. G. Schubert.

SENECIO PAUPERCULUS, var. NEOSCOTICUS, all figs. from TYPE: FIGS. 1 and 2, base, cauline leaves and inflorescence, × 1; FIG. 3, involucre, × 5

swamps and calcareous cliffs, Anticosti Island and Gaspé Peninsula, Quebec, to upper St. John River, Maine (where apparently crossing with *S. pauperculus*, var. *Balsamitae*).

Forma **verecundus** (Fern.), comb. nov. *S. pauperculus*, forma *verecundus* Fernald in Rhodora, xxx. 225 (1928).—Swamps, flats and calcareous talus, Anticosti Island.

With the recognition of *Senecio gaspensis*, the discoid form from Anticosti, of which I now have several numbers, finds its place there.

Var. **firmifolius** (Greenm.), comb. nov. *S. Balsamitae*, var. *firmifolius* Greenm. in Rhodora, vii. 244 (1905). *S. pauperculus*, var. *firmifolius* Greenm. in Ann. Mo. Bot. Gard. iii. 166 (1916).—Stems 0.2–2 dm. high, stiffly erect, often much tufted; undivided basal blades 1–8 cm. long, 0.7–2.5 cm. broad; flowering stem nearly naked except at base or with greatly reduced leaves 1–3.5 cm. long and rarely 1 cm. broad; pedicels 0.2–5 cm. long; achenes 2.4–2.6 mm. long.—Dry calcareous rock, shingle and talus, western Newfoundland; Côte Nord (Betchouane), Anticosti and Gaspé Peninsula, Quebec.

With *Senecio pauperculus*, *S. Smallii*, *S. gaspensis* and, perhaps, *S. plattensis* showing possibly more recognizable characters than they have usually been accorded, there remains the local *S. Crawfordii* Britton. This local species has linear-attenuate phyllaries somewhat as in *S. pauperculus* and its varieties, few large heads and the well developed basal leaves on very prolonged petioles, so that the typical lower blades are only one fifth to one third as long as the erect petioles. The elongation of petiole was probably induced by its often paludal habitat. A most significant character seems to have been overlooked. In *S. pauperculus* and *S. gaspensis* there is a more or less elongate and creeping or decumbent rhizome, from which spring leafy tufts independent of the flowering stem (snatched or merely jerked-up specimens rarely show good rhizomes). In all the material of *S. Crawfordii* I have seen the rhizome is reduced to a short vertical or ascending crown which is praemorse and not creeping. When Mr. Long and I collected in Surry County, Virginia, a few leaf-specimens which we mistook for *S. Crawfordii*, we did not have the rhizome in mind. Our Surry County material (no. 12,892), reported under that name, has a strongly developed horizontal rhizome. It seems to belong with a series collected by Mr. Long, Dr. E. C. Abbe and me, also in Surry County (*Fernald, Long & Abbe*, no.

14,245) which is an unquestioned hybrid of *S. aureus* L. and *S. tomentosus* Michx., the series occurring with the two parents and combining their characters.

Returning to *Senecio Crawfordii*, the short praemorse crown-like rhizome, the very long petioles and the other characters above noted clearly mark it. Although local, the species has a broader range than usually assigned it. I am quite incapable of separating from it the TYPE from Indiana of *S. obovatus*, var. *umbratilis* Greenm. in Ann. Mo. Bot. Gard. iii. 115 (1916). It has the short praemorse erect rhizome, the long-petioled elliptic-oblong basal leaves, the cauline leaves and the heads so nearly identical with isotypic material from Mr. Joseph Crawford himself that the only difference I can see is that the type of *S. obovatus* var. *umbratilis* is in young anthesis, the Crawford material in fruit. Similarly the Tennessee material cited under *S. obovatus* var. *umbratilis* (*S. M. Bain*, no. 421) is so similar to characteristic *S. Crawfordii* from Camden County, New Jersey (*Witmer Stone*), Bristol, Pennsylvania (*Fretz*) and Suitland, Maryland (*Blake*, no. 9391), that it looks as if it were collected with any one of them. Material from open peaty pineland near Middlesex, Nash County, North Carolina, *Godfrey & White*, no. 7017, correctly identified as *S. obovatus*, var. *umbratilis*, is to me inseparable from the Stone, Fretz, Blake and Bain specimens of *S. Crawfordii*, a species which is evidently a southern one reaching a northeastern limit in eastern Pennsylvania and adjacent New Jersey.

Senecio obovatus Muhl. is a stoloniferous plant, with creeping rhizomes derived from the elongate stolons; its obovate to subrotund radical leaf-blades are decurrent into the relatively short and upwardly broadened petioles; its relatively short involucre with few phyllaries abruptly tapering from above the middle. It is very different from *S. Crawfordii*, which is a plant of low grounds (meadows and bogs), whereas *S. obovatus* thrives on calcareous rocky or rich wooded banks; it would be quite unhappy in an acid bog. Not all plants referred in the original account to *S. obovatus* var. *umbratilis* are *S. Crawfordii*, however. Many of them I have not seen, but Bush's no. 1356 from woods, Fulton, Arkansas, is so like a specimen from Williams's Bluff, Knoxville, Tennessee, of the reputedly endemic Knoxville specialty, *S.*

obovatus var. *diversifolius* Greenm. that I can find no difference. The latter very luxuriant series is rather closely approached by overgrown individuals as far away from Knoxville as New England. It seems like overgrowth in unusually favorable conditions.

S. OBOVATUS Muhl., var. **Elliottii** (Torr. & Gray), stat. nov. *S. Elliottii* Torr. & Gray, Fl. N. Am. ii. 443 (1843).

Typical *Senecio obovatus* and its var. *rotundus* Britton are slender and glabrous or promptly glabrescent plants. From the mountains of eastern West Virginia to Alabama and northwestern Florida var. *Elliottii* stands off as a stout plant, with the stems, petioles, often the lower leaf-surfaces and the short pedicels at first arachnoid-tomentose. The radical leaves are more coriaceous than in typical *S. obovatus*, the upwardly dilated petiole obsolete or very short. This is *S. Elliottii* as described by Torrey & Gray, with stem "floccose-woolly when quite young. Radical leaves . . . 2–3 inches in diameter, frequently coriaceous . . . the winged petiole . . . much shorter than the lamina", etc. Torrey & Gray, describing this plant of Georgia, Florida and Alabama, supposed it to be the *S. obovatus* of Elliott, Sketch, ii. 329; but Elliott, describing the plant found on the Santee River, distinctly said "*Stem* . . . glabrous. *Leaves* . . . glabrous," etc. There is certainly doubt whether Elliott had the coarse and pubescent plant of the upland.

The following are characteristic specimens of var. *Elliottii*. WEST VIRGINIA: shaly bank south of Great Capapon, Morgan County, *Pease*, no. 26,587; Milton, Cabell County, *Louis Williams*, no. 309. SOUTH CAROLINA: slopes of Paris Mt., Greenville, *Mackenzie*, no. 2986. FLORIDA: calcareous woods, near Mariana, Jackson County, *Harper*, nos. 53 and 3003. ALABAMA: chalky ravine near Epes, Sumter County, *Harper*, nos. 3001, 3005 and 3159.

*S. PLATTENSIS Nutt. *S. pseudo-tomentosus* Mackenz. & Bush in Trans. Acad. Sci. St. Louis, xii. 88, pl. xvii (1902).—Western Virginia: FREDERICK COUNTY: limestone ledges, Cedar Creek, *Hunnewell*, no. 12,445. SHENANDOAH COUNTY: limestone barrens, Strasburg, *Hunnewell*, no. 14,469; old field 1 mile north of Strasburg, *Allard*, no. 103, as *S. tomentosus*. ROANOKE COUNTY: limestones or dolomites, either wooded or cleared, along Roanoke River, Dixie Caverns, *C. E. Wood, Jr.*, nos. 3387, 3392, 3670, 3687, 3689, 3693, 3694, 5786–5797; steep shaly slope, with limestone ledges, partly wooded, along Roanoke River south-southwest of Wabun, *Wood*, no. 5103.

Although Greenman cites *Senecio plattensis* as extending eastward only to southern Ontario, Michigan, Indiana, Missouri, Arkansas and Louisiana, it has several times been collected in Ohio; and on July 2, 1907, Messrs. W. W. Eggleston, R. W. Woodward and C. A. Weatherby collected very characteristic material of it on limestone cliffs at North Pownal, Vermont, in a general region (southwestern Bennington County) notable for the isolation of more western species, such as *Carex Richardsonii* R. Br. (see Fernald in RHODORA, xxxiv. 229) and *Collinsia parviflora* Dougl. (see Weatherby in RHODORA, xxxvii. 422). Very characteristic *S. plattensis* (including *S. pseudo-tomentosus*) was collected on limestone ledges in Frederick County, Virginia, in 1932 by Hunnewell and soon thereafter by himself and independently by Allard near Strasburg in Shenandoah County. These specimens are inseparable, so far as I can detect, from the Vermont plant and from much *S. plattensis* from Ontario, Ohio, Michigan, Indiana, Wisconsin, Illinois and Missouri, thence westward to the Dakotas, Nebraska, Kansas, etc. They come from more or less open or exposed habitats. Mr. Wood's extensive series from along the Roanoke River is mostly from woods, bluffs and slopes. On the whole it is greener, thinner-leaved and with greater tendency to low forking of the inflorescence, but I am quite incapable of finding any morphological characters to separate it. It is smaller-headed than in some *S. plattensis* but not all, and its low-forking inflorescence and its excessive development of pinnatifid cauline leaves are readily matched in material from Ohio, Indiana, Wisconsin, Illinois, Minnesota, Missouri, Arkansas, etc. It seems to be a shade-state rather than a definite variety. In fact the numbers from less shaded habitats have thicker leaves.

IN PLATE 800, FIG. 1 shows the TYPE (from Clayton) of SENECIO AUREUS L.; FIG. 2, an achene, × 10, from Great Neck, Princess Anne County, Virginia, *Fernald & Griscom*, no. 4517. FIG. 3, achene, × 10, of S. TOMENTOSUS from Buckroe, Virginia, *B. L. Robinson*, no. 410.

PLATE 801, S. AUREUS: FIG. 1, base, × 1, from Great Neck, Princess Anne County, Virginia, *Fernald & Griscom*, no. 4517; FIG. 2, portion of mature basal leaf, × 1, from west of Claremont, Virginia, *Fernald & Long*, no. 12,893; FIG. 3, unexpanded basal leaf, × 2, from Garysville, Prince George County, Virginia, *Fernald & Long*, no. 7984; FIG. 4, portion of unexpanded corymb, × 2, from no. 7984; FIG. 5, involucre, × 5, from western slope of Bull Run Mountains, Fauquier County, Virginia, *Allard*, no. 4540.

PLATE 802, S. AUREUS, var. INTERCURSUS, n. var., all figs. from TYPE: FIG. 1, base, × 1; FIG. 2, foliage, × 1; FIG. 3, corymb, × 1; FIG. 4, involucre, × 5.

PLATE 803, S. AUREUS, var. AQUILONIUS, n. var., all FIGS. × 1, from TYPE: FIG. 1, base; FIG. 2, basal leaves; FIG. 3, cauline leaves; FIG. 4, corymb.

PLATE 804, S. PAUPERCULUS Michx.: FIG. 1, TYPE, × ¾, original photograph by the author; FIGS. 2 and 3, exceptionally tall plant, × 1, from wet peat, Port aux Basques, Newfoundland, *Fernald, Long & Dunbar*, no. 27,160; FIG. 4, basal tuft, × 1, from no. 27,160.

PLATE 805, S. PAUPERCULUS, var. BALSAMITAE (Muhl. ex Willd.) Fern.: FIG. 1, one of the two plants of type-sheet, × ¾, courtesy of Professor *Diels;* FIGS. 2 and 3, flowering stem, × 1, from near Mt. Hope, Lancaster County, Pennsylvania, June 5, 1900, *Heller;* FIG. 4, basal tuft, × 1, from same collection; FIG. 5, involucre, × 5, from same collection.

PLATE 806, S. PAUPERCULUS, var. NEOSCOTICUS, n. var., all figs. from TYPE: FIGS. 1 and 2, a single plant, × 1; FIG. 3, involucre and pedicel, × 5.

*CIRSIUM VIRGINIANUM (L.) Michx., forma **revolutum** (Small), stat. nov. *Carduus revolutus* Small, Fl. Se. U. S. 1307 and 1341 (1903). *Cirsium revolutum* (Small) Petrak in Beiheft. Bot. Centralbl. XXXV. Ab. 2: 558 (1927). SUSSEX COUNTY: exsiccated argillaceous pineland about 2 miles east of Stony Creek, no. 9223.

Most certainly *Cirsium revolutum* is not a distinct species. In all characters it is like *C. virginianum* except that its lower and median cauline leaves are broader and deeply pinnatifid. Typical *C. virginianum* (as shown by a photograph of the type as well as by the original description) has the very numerous cauline leaves lance-acuminate, the lower and median ones only 0.5–1.5 cm. wide, entire or with remote, divergent, short, subulate prickles. This plant occurs in wet pineland or sphagnous or peaty bogs, swales and clearings, mostly on the Coastal Plain, from Florida to New Jersey. In forma *revolutum*, which has the same broad range, from Florida to New Jersey, the lower and median cauline leaves are 1.5–4 cm. broad and deeply pinnatifid, with lanceolate to narrowly triangular simple or forked or toothed long-pointed lobes, while the reduced upper leaves may be similar, though smaller, or quite like those of typical *C. virginianum*. The two forms seem to occur in somewhat pure stands so that all of a single station are more or less uniform. Forma *revolutum* is worthy that much recognition but surely it is not a distinct species.

Cirsium virginianum is generally supposed to extend westward to Texas, thence northward to southern Ohio, southern Indiana and southern Missouri. The plant of the Interior, however, is *C. flaccidum* Small, although its author missed some of its most important characters and restricted it to "Low pinelands, Coastal Plain, Fla. to N. C.," while the plant of the Interior

was left in *C. virginianum*. True *C. virginianum* has tuberous-thickened first year's roots (a character rarely shown in the herbarium), *C. flaccidum* slender root-fibers; *C. virginianum* has very numerous (40–70 or more) firm or coriaceous cauline leaves, *C. flaccidum* few (10–20) thin and flexible ones. In *C. virginianum* the peduncle-like flowering branches have several bractei-form leaves, in *C. flaccidum* the peduncles are naked or with only 1 or 2 bracts; in *C. virginianum* the involucre is 1.5–3 cm. high, in *C. flaccidum* only up to 2 cm. high. *C. virginianum*, of savannahs, bogs and wet pinelands of the Coastal Plain from Florida to New Jersey, flowers from mid-August to October. *C. flaccidum* of dry, acid woods, thickets and ravines, from Georgia (Small says North Carolina) and northern Florida to Texas, north to southern Ohio, southern Indiana and southern Missouri, flowers in May and June, sometimes in April.

The following taken from the Carolina and Virginia sheets in the Gray Herbarium of *Cirsium virginianum*, give, in corroboration, the habitats and flowering dates: sphagnous bog, Sept. 13; boggy depression, Oct. 18; low woods, Oct. 15; open pine and oak woods, Sept. 18; clearing, Aug. 19 (first flowers); damp pineland, Sept.; bog or savannah, Sept. 10; exsiccated argillaceous pineland, Aug. 24; pineland, Aug. 28 (first flowers); savannah, Oct. 13; pineland, Oct. 13 and Aug. 29 (first flowers); savannah, Sept. 1; sphagnous bog, Sept. 10; bog or savannah, Sept. 10 and 11. Average date September 15. All material in the Gray Herbarium of *Cirsium flaccidum* with sufficient data gives the following result: dry woods, Lookout Mountain, northern Georgia, June 4; woods near Chattanooga, Tennessee, May 23; dry woods, Talledega Co., Alabama, May 22; head of deep ravine, with *Kalmia latifolia*, Perry County, Indiana, June 4; upland woods, Polk County, Texas, May 23; dry bank, Houston, Texas, April 18. Average date May 23. Such data, associated with the different roots, many and firm or few and pliable leaves, bracted or nearly naked peduncles, etc., are decisive.[1]

[1] Sir John Hill in 1765 separated the boreal genus *Oxyria* from *Rumex*. Somewhat later Sir James Edward Smith, obviously with his own views of the general soundness of Hill's work, wrote (the reference kindly given me by Dr. Blake): "Sir John Hill, it seems, first separated this plant from *Rumex*, and gave it the above generic name. Sometimes, as Linnaeus says, a blind hen meets with a grain of corn."—Sm. Engl. Bot. ii. 189 (1828). Small had a good species but he did not know its best characters nor its range.

*Hieracium venosum L., var. nudicaule (Michx.) Farwell. For discussion see Fernald in Rhodora, xlv. 323 (1943). The only Virginian material I have seen is from the slopes of Bull Run Mountains, Prince William County, *Allard*, no. 647 and 3321. The plant of the Tidewater region is typical *H. venosum*.

A further Note on the Date of Pursh's Flora[1].—In Rhodora **40:** 354 (1938) Professor Fernald accepts 1814 as the date of Pursh's *Flora* but nevertheless accords it priority over certain plates in the *Botanical Magazine* dated by the engraver "Nov. 1, 1813" and "Dec. 1, 1813", on the assumption that these dates refer to the engraving of the plates and do not mean that the plates so dated were issued with their accompanying text on November 1 and December 1 respectively. Such a statement indicates a misconception of the purpose of the dates on eighteenth and nineteenth century prints. The plates of the *Botanical Magazine* and similar publications were dated in order to comply with the British print copyright Acts of 1734, 1766 and 1777 which gave legal protection to the inventors, designers and engravers of prints for the term of fourteen (or, after 1766, twenty-eight) years "to commence from the Day of the first publishing thereof, which shall be truly engraved . . . on each Plate, and printed on every such Print or Prints" (cf. *Journ. of Bot.* **78:** 67; 1940). Since the dates on these prints were intended to be those of their first publishing, they had to be engraved upon the plates in advance of publication and it may be that circumstances unforeseen at the time of engraving occasionally delayed publication beyond the dates given. Yet, to judge from some contemporary reviews, the issue of the monthly parts of the *Botanical Magazine* was fairly regular and in the absence of evidence to the contrary the dates engraved on its plates, though possibly not always correct to the day, must be accepted as correct to the month. They can be checked by reference to the *General Indexes to . . . the first forty-two Volumes of the Botanical Magazine* (1817) which give the contents and month of issue of each part. The title-page of volume **39** is dated

[1] In Rhodora, xlv. 415 (1943) the Editors added a footnote which, owing to the long delay in hearing from the author of the article, was allowed to stand. It now appears that it and the item referred to were based on misconception. We apologize.—Eds.

"1814" but that is the date of the first part; the first part (no. 322) was issued in November 1813. Thus *Rudbeckia columnaris* Sims (*Bot. Mag.* **39:** t. 1601; Dec. 1813) antedates *R. columnaris* Pursh (Jan. 1814) and *Lophiola aurea* Ker-Gawl (*Bot. Mag.* **39:** t. 1596; Nov. 1813) antedates *Conostylis americana* Pursh (Jan. 1814).—W. T. Stearn.

LILIUM MICHIGANENSE, L. CANADENSE AND L. SUPERBUM

Edwin D. Hull

In an article in this Journal[1], in which a wild lily from the Lake Michigan dune country of northern Indiana, called by some botanists *L. michiganense*, was compared with typical *L. superbum*, mostly from the Atlantic Coastal Plain, I concluded that *L. michiganense* was not valid, being in reality *L. superbum*. To this article Dr. Wherry[2] took considerable exception, concluding that *L. michiganense* was nearer *L. canadense* than it was to *L. superbum*, and that all three should be considered distinct, "though not necessarily in species status". Constructive criticism is welcome, but, after further field and herbarium study, I can see no reason for separating *L. michiganense* from *L. superbum* and, furthermore, *L. superbum* and *L. canadense* are distinct species.

In the dune country of Indiana there are many areas of marsh, bordering which in some instances are low woods. The lilies are found in both habitats, mostly, however, in the open. Much of this country has been drained and turned to cultivation, but there are still hundreds of flowering specimens, and many more plants which have deteriorated to a degree where they no longer flower, although they persist in a vegetative state for many years. I think no botanist would doubt after seeing these lilies that all the plants were of the same species.

Leaf-Indument. I cannot see that this is a good diagnostic character, as it is obviously a matter of environment in the specimens I have studied. The spring and early summer of 1943

[1] *Lilium superbum and L. michiganense.* Rhodora **44:** 220. 1942.
[2] *Relationship of Lilium michiganense.* Rhodora **44:** 453. 1942.

being unusually wet, some plants were found in the open with the spicules reduced to little more than papillae, whereas they are usually well-developed. In woods spicules are present usually only along the margins, the rest of the leaf being entirely smooth. In one locality, where the lilies seemed more exposed than usual, spicules were present over the entire lower surface. This is true also of the first leaves to appear above ground, which are little more than scales, and have a protective function. In my first paper were noted two specimens of typical *L. superbum* from xeric habitats, one in a salt marsh, and the other from dry, sandy soil, and the leaves of these were as roughened as any I have ever seen in the Indiana dunes.

Coloration. In 32 specimens the green zone was 10 or more mm. long in 22 cases, too many to be considered as otherwise than normal. This zone was distinct except toward the apical end, and was visible or invisible when the flower was viewed face-on according to the length of the zone and the curvature of the segments.

Stamens. As to anther-length, of 33 specimens 9 were 12 or more mm. long, the required length, it seems, for *L. superbum*. Care was taken to examine only those flowers which seemed typical, and 9 of 33 seems rather too many to be called "aberrent". Some of the flowers were studied at mid-anthesis; others could not be studied until after the pollen had been shed, when the anthers were considerably shortened. In a 2-flowered plant the anthers of one at mid-anthesis were 12 mm. long, whereas in the other flower with shed pollen the length was only 8 mm. The average anther-length was slightly more than 10 mm., whereas two years ago, as reported in my first paper, the average was about 16 mm.[3] The plants of the dune country are gradually deteriorating and consequently bearing smaller flowers, and it has been my observation that small flowers mean short anther-length as a rule. In my experience garden specimens also deteriorate after a few years.

What seems to me an important, and in my experience an entirely constant, character separating *L. superbum* from *L. canadense* is in the filaments. In *L. superbum* the upper portions

[3] A correction should be made in my first paper, p. 226, line 20. 11–12 mm. should read 11–22 mm.

of the filaments are strongly curved outward for about one-third (or perhaps more) the entire length, causing the anthers to be widely separated. In *L. canadense* the filaments are straight or nearly so throughout, causing the anthers to form a close cluster about the style. These differences are beautifully illustrated in paintings by Miss Mary E. Eaton, where *L. superbum* and *L. canadense* are shown on the same page[4]. All specimens of the so-called *L. michiganense* I have seen have filaments of the *L. superbum* type.

RIBBING OF PERIANTH-SEGMENTS. Of 30 specimens, except for two examples, the sepal-midrib was of the *L. canadense* type as shown by Wherry. One of the exceptions showed two ridges much more rounded than those illustrated by Wherry for *L. superbum;* the other showed a number of veins which were well-raised, instead of being imbedded in the other tissues. The petal-midrib in these 30 plants showed horizontal or nearly horizontal ridges in 28 cases, the other two being only slightly rounded. Whether the ridges were narrow or wide seemed to depend on the size of the flower, there being some variance in this respect. On the whole the petal-midrib is of the *L. superbum* type.

SEEDS. Seeds of the Indiana dune plants resemble those of typical *L. superbum* from the Atlantic Coastal Plain, in size, as well as other features. But they are much larger than the seeds of *L. canadense*, a typical seed being 10 mm. long (including wing) as compared with 6 mm. long in *L. canadense.*

CONCLUSIONS. It seems to me that *L. superbum* and *L. canadense* are distinct species. I cannot find any vegetative character that will sharply differentiate the two, but there are fundamental differences in the reproductive structures, and I believe botanists agree that such characters are much more stable than the vegetative ones. The so-called *L. michiganense* resembles altogether too much *L. superbum* to be removed from it, in my opinion. Mr. George L. Slate, an authority on lily-culture, in a recent article[5] does not recognize *L. michiganense*, although he mentions *L. superbum* and *L. canadense.* Slate gives the flowering time of *L. superbum* as July, the usual time for the lilies of the dune country to flower.

[4] The Book of Wild Flowers, p. 154. National Geographic Soc., 1933.
[5] The Home Garden 1: 56. July, 1943.

The following key may be helpful in distinguishing *L. superbum* from *L. canadense*.

PERIANTH-segments strongly recurved; upper portion of filaments strongly curved outward, anthers widely separated; seeds comparatively large.....*L. superbum.*
PERIANTH-segments moderately recurved; filaments straight or nearly so; anthers close together or in contact; seeds comparatively small.....*L. canadense.*

I wish to express my appreciation of courtesies extended by the staff of the Department of Botany of the Field Museum of Natural History.

GARY, INDIANA.

EDIBLE PLANTS.—Most botanists know ten or a dozen wild plants which are useful as food but after reading this excellent and authoritative work by Professors Fernald and Kinsey[1] the number available will reach well over 1,000. It is to be hoped that the welcome and enthusiastic cry, "There's such and such a genus, new to the region", so familiar to field-botanists, will not be too suddenly changed to, "There's Spring-Cress, we'll have it for salad at lunch!" Not only does the book make you want to get out the vasculum and digger which have been put away for the winter, but it stirs the desire for field-work of quite a different sort. Many species can be eaten during the cold months and if you read carefully, you will realize that the following of this fascinating subject can keep you adequately supplied with nourishment, if not with luxuries, for twelve months of the year.

The book has long been in preparation and that it is published during these critical times is a welcome fact; with its aid many ration coupons will be saved. It is a comprehensive volume, embracing all groups of plants, both cryptogams as well as phanerogams, and is copiously illustrated. Each species is clearly described so that one should encounter no difficulty in the identification of the plants. However, to make quite certain that no mistakes will be made on the part of those persons not intimately acquainted with the flora of the region, an excellent chapter entitled "POISONOUS FLOWERING PLANTS LIKELY TO BE MISTAKEN FOR EDIBLE SPECIES" is included. Here one finds a complete discussion of the poisonous elements, a warning as to which edible plants the poisonous ones closely resemble, and a lucid description of the lethal organs. Because these poisonous species are further classified as to the part containing the toxic principle, *i. e.* whether root, stem, leaf or fruit, it is difficult to see how errors in determination can possibly occur. In addition, careful and explicit instructions concerning the poisonous fungi are included. These are printed in **bold face type** which is a further help.

In the organization of the chapters the authors have shown excellent judgment. The first, a long one, classifies the edible wild plants according

[1] *Edible Wild Plants of Eastern North America*, by MERRITT LYNDON FERNALD and ALFRED CHARLES KINSEY. (*Special Publication*, THE GRAY HERBARIUM OF HARVARD UNIVERSITY.) The Idlewild Press, Cornwall-on-Hudson, N. Y., 1943. xiv + 452 pp. $3.00.

to uses. Thus, we find grouped together those plants suitable for purées and soups, those used as starchy or root-vegetables, cereals, nuts and breadstuffs, those which furnish cooked green vegetables, and so on. The lists are comprehensive so that anyone wishing to plan a menu consisting chiefly of native plants, can quickly go through these, making his selections from such plants as are in season and easily obtainable. The second chapter contains the admonitions regarding poisonous plants mentioned above. The third one discusses at length each species of flowering plant which possesses an edible part. The plants are systematically grouped into families, genera and species. For each species there is given an extremely clear but brief description, together with the complete range of the plant in North America, and its use or uses in culinary art. There follows a good discussion, including valuable historical material embracing significant facts from Indian lore, the personal experiences of the authors as well as those of their scientific colleagues and predecessors, together with numerous recipes. Each of these discussions is written so entertainingly and is so crammed full of useful knowledge and folklore that one can spend hours rereading them. The recipes themselves are splendid; many are quite new and have never been previously published. Even those plants about which culinary references have been made but which the authors have not personally tried are included. In such cases appropriate comments and other suggestions are freely given. The last two chapters contain the descriptions of the cryptogams and their edible species, and the bibliography.

The bibliography contains over 175 references to botanical and other journals, books, and monographs. Although the authors warn us that it is by no means complete, it is certainly comprehensive. The fact that many species owe their palatability to the experimentation of pioneer botanists, naturalists and explorers, to say nothing of the old country cookbooks of many years ago, and that these references are available in one volume, gives to the list an added significance. Though space has been a limiting factor and only short comments are included in many instances, the references to the original sources will furnish those readers desirous of delving deeper into certain aspects of the subject an excellent opportunity to explore further this vastly interesting field.

Because of the complete range given for each plant, persons living outside the region defined by the title will find the volume especially useful. About two-thirds of the species mentioned occur in the South and Middle West. This fact enhances the utilitarian value of the book and it is to be hoped that its universal interest will extend to those areas outside of "eastern North America".

The authors have succeeded admirably in their endeavor. The book is really superb in every regard and should enjoy widespread popularity. For botanists and naturalists it is, of course, a "must". For the home economist it is essential. The general reader, garden-club enthusiast and amateur scientist will also find it of immense interest.

In no sense has scholarship been sacrificed for the sake of popular appeal to the layman. But one feels that the book was written from sheer pleasure in the knowledge gained from long field-experience and with a desire to make available to others these rich accomplishments. That it is accurate and scientific as well as being written in simple, nontechnical language is an achievement for which the authors deserve great credit.

And it completely surpasses in every aspect other, and comparatively recent, books on the same general subject.

So many works are written expressly for the layman that the lessons gained from them are usually lost in the subjective viewpoint which most authors unconsciously assume. *Edible Wild Plants* consistently maintains the high standard of objectivity which its authors have set for it. As a result the layman profits immeasurably and at the same time the natural scientist is provided with a critical and scholarly book, at all times useful as a reference work of supreme importance.—Milton Hopkins, The University of Oklahoma, Norman, Oklahoma.

Trillium undulatum Willd., forma **Cleavelandicum** (Wood), comb. nov. *T. erythrocarpum*, var. *Cleavelandicum* Wood, Cl.-bk. ed. 2: 546 (1848). *T. Cleavelandicum* Swallow ex Wood, l. c., as synonym.

Although the handsomest of our species of *Trillium*, *T. grandiflorum*, is the most fickle and sporty member of the genus, with scores of described aberrant variations, the Painted Trillium, *T. undulatum*, sometimes sports, as indicated by the late Walter Deane who, in Rhodora, x. 21–24 and 214–216 (1908), described in detail plants of forma *Cleavelandicum* with the sepals simulating foliage-leaves and the true leaves in 1–3 distant whorls, and the frequent forma *polymerum* Victorin, in which the leaves are 4 or more (up to 8) in a single whorl and the flowers 4–8-merous. Forma *Cleavelandicum* was described almost a century ago, Wood's account following.

> β. *Cleavelandicum* Wood. (T. Cleavelandicum. *Swallow!*) *Sep.* developed into leaves, which are but little smaller than the true leaves; *pet.* 6, the 3 outer but partly colored. Otherwese as in α.—Brunswick, Me.! This is probably a metamorphosis; but Mr. S. has gathered it three years in succession, and also finds it thus far unaltered when cultivated from the root. Its claims to the rank of a species must be tested by plants reared from the seeds. (*Dr. T. Rickard* comm.)

Although there is no indication of the source of the name given by Mr. Swallow and taken up by Wood, it is obviously in honor of Parker Cleaveland (1780–1859), for many years President of Bowdoin College in Brunswick, where Mr. Swallow found the plant.

A sheet of the original material, sent by Mr. Swallow to Asa Gray, was discussed by Mr. Deane. In that material the petals are 6; the several sheets of specimens from Holderness, New

Hampshire, described in detail by Deane, show either 3 or 6 petals.—M. L. FERNALD.

THE QUEBEC STATIONS FOR SCIRPUS PECKII.—On p. 168 I recorded *Scirpus Peckii* as collected at Bellerive, Beauharnois County, Quebec, the name of the county supplied me by a native of the Province. Mr. Ernest Rouleau, Curator of the Herbarium of the University of Montreal, now writes me that the station is really at another Bellerive, this one in Labelle County. In addition to the station in Labelle (not Beauharnois) County, Mr. Rouleau calls my attention to a station on the border of Lac à la Barbotte, Saint-Jerome, Co. Terrebonne, 7 août 1940, *Victorin & Rolland*, no. 56,478. The material is thoroughly characteristic.—M. L. FERNALD.

Volume 45, no. 539, including pages 417–480 and plates 783–795, was issued 13 November, 1943.

ERRATA

No. 529, Contents, line 8; *for* Bibliography *read* Biography.
Page 102, line 13; *for* West Chester *read* Westchester *and transfer* ; near Peekskill, Westchester Co., 1868, *LeRoy* to line 5 after *Topping 203.*
Page 252, line 35; for *virginicum* read *virginicus.*
Page 245, line 36; *for* Nanasquan *read* Manasquan.
Page 255, line 34; for *spica* read *spicis.*
Page 277, line 42; for *Archaechamy-* read *Archichlamy-.*
Page 375, line 30; *for* incone *read* income.
Page 414, line 8; for *Trapogan* read *Tragopogon.*
Page 420, line 2; for *donias* read *doniae.*
Page 432, line 31; for *subpumosa* read *subspumosa.*
Page 443, line 31; *for* verious *read* various.

INDEX TO VOLUME 45

New scientific names are printed in full-face type

Abbe, E. C., New Oxytrope of the Minnesota-Ontario Border, 1, pl. 745
Abies, 108; amabilis, 108; lasiocarpa, 108; nobilis, 108
Acer, 108, 364; floridanum, 363, 379, 453; grandidentatum, 273, 274; saccharum, 273, var. grandidentatum, 274
Acerates viridiflora, 458, var. lanceolata, 458
Achillea borealis, 316; lanulosa, f. rubicunda, 116
Aconitum delphinifolium, 310
Adams, J. W., A Double-flowered Form of Gillenia trifoliata, 215
Aesculus discolor, 383, 453; neglectus, var. pubescens, 383, 453
Agropyron latiglume, 308
Agrostis filiformis, 228, 230, 236; filiformis *α*., 230; filiformis *β*., 230; foliosa, 223, 229, 230, 235, 238, pl. 749, f. ambigua, 230; frondosa, 228–230, 235, 238, pls. 749, 750; lateriflora, 226, 227, var. filiformis, 236; mexicana, 223–226, 228, 236, 238, pl. 751; racemosa, 231, 235, 237, 238, pl. 753; setosa, 237
Albino Lupine, Our, 356
Alchemilla pratensis, 27, in Erie County, New York, 27
Alder, Common Northern, 30
Aletris aurea, 114; farinosa, 114; lutea, 114
Alisma, 53
Allard, H. A., Probable Relationship of Phaseolus polystachios to other Species, 169
Allies in eastern North America, Senecio aureus and its Geographic Varieties and, 495–509, pls. 800–806
Alnus, 109; crispa, 310; incana, 30
Alopecurus glomeratus, 237
America, Centaurea nervosa in, 331; Vicia tetrasperma, Var. tenuissima in, 480
American Representative of Scirpus pumilus, The, 279, pls. 762–764
Amianthium Muscaetoxicum, 369, 374, 393
Amsonia, 328; ciliata, var. filifolia, 328, 329; from the Ozarks of Arkansas, New, 328; **Hubrichtii, 328,** 329; illustris, 329; "tabernaemontana", 329; Tabernaemontana, 380, 457
Amygdalus, 451
Andropogon, 389; alopecuroides, 250–252, 255, pl. 761; divaricatum, 252–255, pl. 761; furcatus, 255, 256, 258; Gerardi, 256, 258, Why not, ?, 255, var. **chrysocomus, 258,** var. **paucipilis, 258;** nutans, 252–255; provinciale, 256; provincialis, 255–258, var. chrysocomus, 258, subvar. furcatus, 257, subvar. genuinus, 257, var. paucipilis, 258; scoparius, 377, 390, var. genuinus, f. **calvescens, 390,** var. villosissimus, 390; spicis digitatis, etc., 255; virginicus, 252, var. glaucopsis, 461
Andropogoneae, 248, 254, 256
Angelica, 299; atropurpurea, 298, 299; Curtisii, 298, 300; hirsuta, 298, 300, 301; hirsuta triquinata, 298; triquinata, 298–301, What is, 298–301; **venenosa, 301;** villosa, 298, 300, 301
Annual, Potamogeton Spirillus may grow as an, 329
Annotated Catalog of Spermatophytes of Kentucky, An, (Review of), 277
Anonaceae, 443
Anthoxanthum, 250; giganteum, 249–251
Ants, Carunculate Seed Dissemination by, 438
Apios Priceana, 278
Apple, 450, 451
Aquilegia brevistyla, 310; canadensis, 277
Arabidopsis Thaliana, 268
Arabis, 114; canadensis, 114, 115; hirsuta, var. pycnocarpa, 311; laevigata, 358; missouriensis, 269, 273, var. **Deamii, 269;** viridis, 269, var. Deamii, 269
Archichlamydeae, 277
Archangelica hirsuta, 301
Arctagrostis arundinacea, 308
Arctic Canada (east of 100° W.), Taraxacum in, 337

Arctostaphylos rubra, 314
Arenaria, 268; macrocarpa, 310
Arisaema Dracontium, 274; triphyllum, 277
Arizona (Review), Flora of, 26
Arkansas, New Amsonia from the Ozarks of, 328
Arnica attenuata, 316; lonchophylla, 316
Aronia, 451
Artemisia arctica, 316
Arthur Herbert Norton, 217
Arundinaria gigantea, 461
Asarum, 374, 381–383, 399; § Heterotropa, 374, 399, 400; arifolium, 398, 399; canadense, 398, 399; **Lewisii, 398**–400, **pls. 774, 775**; Ruthii, 398, 399; Shuttleworthii, 400; virginicum, 399, 400
Asclepias lanceolata, var. paupercula, 368, 458, 461, f. **flaviflora, 458**
Ash, White, 274
Asimina parviflora, 370, 412
Aster, 344, 350, 361, 485; acuminatus, 345, 350; acuminatus × nemoralis, 350; alpinus, 316; × Blakei, 345, 350; ciliolatus, 344, 346; cordifolius, 344, 346; Cusickii, 348; Elliottii, 461; foliaceus, 344, 345, 347–349; gymnocephalus, 351; junceus, 348, 349; junciformis, 348; in Nova Scotia, Genus, 344; lateriflorus, 345, 346, var. tenuipes, 346; Lindleyanus, var. ciliolatus, 346; longifolius, 348, 349; luteus alatus, 487, 495, pl. 797; macrophyllus, 344, 345, var. velutinus, 345; major, 350; montanus, 263; nemoralis, 345, 350, var. Blakei, 350, var. major, 350; novae-angliae, 345, 349; novi-belgii, 347, 348; paniculatus, 345, 347, 349; puniceus, 344, 345, 348, 349; radula, 345, 346, var. strictus, 346; Richardsonii, 263, 264, var. meritus, 263, 264; **Rolandii,** 344, 345, **347,** 348; rubiginosus, 351; salsuginosus, 262–264; salsuginosus, Richardson, Identity of, 262; saxatilis, 347; sibiricus, 264, 316; **tenuipes,** 345, **346**; Tradescanti, 345–347; umbellatus, 345, 350; undulatus, 344–346
Astragalus frigidus, 313, var. dawsonensis, 313, var. littoralis, 313
Atwood, Alice C., (Review of work), 56
Avena glumosa, 242; spicata, 242
Axis upon the Cones of Tamarack, Development of a Leafy, 106
Azalea, 451

Babel, William K., Varieties of Brachyelytrum erectum, 260
Baccharis, 116; texana, 116
Bakewell, Anderson, Botanical Collections of the Wood Yukon Expedition of 1939–1941, 305
Barbarea hirsuta, 304; stricta, 304; vulgaris, 304, Our Varieties of, 304, var. arcuata, 304, f. **hirsuta, 304,** f. **plena, 304**; vulgaris, β. bracteata, sub-var. hirsuta, 304, var. brachycarpa, 304; vulgaris, subsp. euvulgaris, subforma hirsuta, 304, var. hirsuta, 304, var. sylvestris, 304
Bastard Sun-flower, 486
Bean, 169; Kidney, 169, 170; Wild, 170
Bean, Ralph C., Arthur Herbert Norton, 217
Bebb Herbarium of the University of Oklahoma—II, Notes from the, 265
Beech, 377
Berberidaceae, 443
Berneuxia, 333–335, On the Sino-Himalayan Species of Shortia and, 333; thibetica, 333, 335, 336; **yunnanensis,** 333, **336**
Betula, 108
Betulaceae, 310
Bidens, 53
Big Bend of Texas, New Streptanthus from the, 258
Biography (Review), An Important, 28
Blake, S. F., Cotype, Syntype, and other Terms referring to Type Material, 481; (Review of work), 56
Bleeding Heart, 442
Bloodroot, 438, 439
Blysmus rufus, 287
Boivin, Bernard, The "Coûdres" of the "Ysle es Couldres", 29
Boltonia caroliniana, 379, 478
Booth, W. E., New Species of Deschampsia, 414
Boraginaceae, 315
Border, New Oxytrope of the Minnesota-Ontario, 1, pl. 745
Botanical Collections of the Wood Yukon Expedition of 1939–1941, 305

Botanizing under Restrictions, Virginian, 357–413, 445–480, 485–511, pls. 770–806
Brachyelytrum aristatum, var. Engelmanni, 260, 261; aristosum, var. glabratum, 260–262; erectum, 260, 261, Varieties of, 260, var. **septentrionale, 260,** 261
Brassica, 277; nigra, 277
Braun, E. Lucy, (Review of work), 277
Brazoria scutellarioides, 275
Broad-leaved Species of Potamogeton of North America north of Mexico, The, 57–105, 119–163, 171–214, pls. 746–748
Buckeye, 383
Bulbostylis ciliatifolius, 369, 390
Burgrass, 387, The common northern, 387
Butters, Fred K., New Oxytrope of the Minnesota-Ontario Border, 1, pl. 745

Cabomba caroliniana, 368, 400
Cacti, 26
Cain, Stanley A., Note on "Fossil Evidence of wide Post-Pleistocene Range for Butternut and Hickory in Wisconsin", 107
Callirhoe involucrata, f. **incisa, 271**
Calopogon pallidus, 369, 398
Caltha natans, 53, 54, 214, in Canada, 214; in Minnesota, Rediscovery of, 53
Camelina, 277
Camponotus, 440, herculeanus pennsylvanicus, 445
Canada, Caltha natans in, 214; Revision of the Perennial Species of Geranium of the United States and, 5–26, 32–53; Scirpus Peckii in, 168; (east of 100° W.), Taraxacum in Arctic, 337
Cape Henry, Virginia, The Seashore State Park, a Part of, 105
Cardamine bulbosa, 359; Douglassii, 360; purpurea, 311
Carduus muticus, var. subpinnatifidus, 353; pinetorum, 353; revolutus, 509; vittatus, 353
Carex, 241; allegheniensis, 167; aquatilis, 308; assiniboinensis, 167; Bayardi, 367, 393; brunnescens, 167; Buxbaumii, 278; Collinsii, 366, 367, 393; comosa, 278; debilis, var. pubera, 167, var. Rudgei, 167; decomposita, 373, 393; flexuosa, 167, in Minnesota, 167; gracillima, 167; pennsylvanica, 167; Richardsonii, 508; scoparia, 167; venusta, 367, 393; virginiana, 393
Carrizo Sands of Texas, The Wild Cherry of the, 325
Carunculate Seed Dissemination by Ants, 438
Carya, 107, 108; cordiformis, 107
Caryophyllaceae, 310
Cassia Chamaecrista, 302
Castalia, 443
Castilleja pallida, ssp. elegans, 315
Castor Bean, 439, 440
Catalogue of the Vascular Plants of Kentucky, A, (Review of), 278
Celandine, 441, 442
Celastraceae, 444
Cenchrus, 388; carolinianus, 387; echinatus, 387, 388, f. longispinus, 388; incertus, 387, 388; **longispinus, 388;** pauciflorus, 387, 388; tribuloides, 387
Centaurea Jacea, 331, var. nigra, 332; nervosa, 332, in America, 331; nigra, 331; nigrescens, 331
Central New York, Scabiosa Columbaria in, 220
Centrosema virginianum, var. ellipticum, 278
Cephalanthus, 371, 380
Cerastium, 358; Beeringianum, 310; brachypetalum, 358, 359, 400; tetrandrum, 359
Cerasus, 451
Check-list of Kentucky Plants (Review), A, 278
Chelidonium majus, 441, 444
Chenopodiaceae, 310
Chenopodium capitatum, 310
Cherry, 325, 326, 451; of the Carrizo Sands of Texas, The Wild, 325
Chloris, 257
Chrysanthemum, 485
Chrysopogon Elliottii, 255
Chrysosplenium beringianum, 311
Cicuta venenata, 300; venenosa, 300–302
Cinna, 227, 234; filiformis, 236; glomerata, 237; lateriflora, 226, 227; racemosa, 237
Cirsium, 353, 354; altissimum, 356; flaccidum, 509, 510; Flodmani, 356, Eastern Extension of, 356; horridulum, 353, f. **Elliottii, 353,** var. Elliottii, 353; Minor Transfers and Forms in, 353; muticum, f. **subpinnatifidum,**

353, var. subpinnatifidum, 354; odoratum, 354; pinetorum, 353; pumilum, 354, f. **candidum, 354,** f. **fultius, 354;** revolutum, 509; Smallii, 353; undulatum, 356; virginianum, 365, 509, 510, f. **revolutum, 509;** vittatum, 353
Cladinae, 417, 420
Cladium jamaicense, 461
Cladonia, 417, 418; subgen. Cladina, 417–420, 426, 437; Subgenus Cladina, Microchemical Studies on the Genus, 417; subgen. Cenomyce, 426; alpestris, 418–421, 427–431, 433, 434, 437, f. aberrans, 419, 429–432, f. inturgescens, 429; Evansi, 418–420, 427, 437; fallax, 437; furcata, 428; impexa, 417–420, 427, 432, 437, f. exalbescens, 418; impexa-spumosa, 432; leucophaea, 437; mitis, 420, 426, 427, 431, 432, 434–437, f. divaricata, 432, 436, m. divaricata, 436, f. laevigata, 434, f. prolifera, 437, m. prolifera, 436, f. prostrata, 432, m. prostrata, 435, f. soralifera, 437, f. tenuis, 434, f. vesciculosa, 432; mitis-divaricata, 436; pseudo-evansi, 418, 419, 427, 437; rangiferina, 417, 437, c. alpestris, 430, var. alpestris, 430; rangiformis, 426; Sandstedei, 437; subimpexa, 418; **submitis, 424, 435**–437, f. **divaricata, 436,** f. **prolifera,** 424, **436,** f. **soralifera, 437;** sylvatica, 417, 420, 432, 437, f. morbida, 433; sylvatica-subspumosa, 432; tenuis, 420, 432, 437, subsp. subtenuis, 437
Clausen, R. T., Scabiosa Columbaria in Central New York, 220
Claytonia sp., 310; sarmentosa, 310
Clematis, 410; § Viorna, 405, sub-§ Integrifoliae, 366, 401, 410; albicoma, 402–409, 412, pl. 779, var. **coactilis,** 406, **407,** 409, 410, 412, **pl. 780;** crispa, 359; Fremontii, 410–412, pls. 781, 782, var. Riehlii, 411, 412, pl. 782; glaucophylla, 277; integrifolia, 410, 412, pl. 778; ochroleuca, 366, 401–410, 412, pls. 776, 777, and Allies, Morphological Differentiation of, 410, pls. 776–782, [var.] ovata, 401, var. ovata, 408,]var.] sericea, 402, 409, var. sericea, 406–409; ovata, 408, 409, 412; sericea, 406, 409, 410, 412, pl. 777; Viorna, 405; viticaulis, 402–409, 412, pl. 778
Clover, Red, 331
Cnicus horridulus, 353; odoratus, 354; pumilus, 354
Cnidoscolus stimulosus, 270, 271; texanus, 270, 271
Coastal Dunes of Texas, The Senecio on the, 164
Collections of the Wood Yukon Expedition of 1939–1941, Botanical, 305
Collinsia parviflora, 508
Combination in Pyrus, New, 28
Commelina diffusa, 377, 393
Common northern Burgrass, The, 387
Compositae, 27, 308, 316
Composite, 351
Cones of Tamarack, Development of a Leafy Axis upon the, 106
Conostylis americana, 415, 512
Contributions from the Gray Herbarium of Harvard University—No. CXLVII, pp. 57–105, 119–163, 171–214, pls. 746–748; No. CXLVIII, pp. 221–258, 279–303, 317–325, pls. 749–769; No. CXLIX, pp. 357–413, 445–480, 485–511, pls. 770–806
Cory, V. L., New Streptanthus from the Big Bend of Texas, 258; The Perennial Helenium of the Edwards Plateau of Texas, 109; The Senecio on the Coastal Dunes of Texas, 164; The Wild Cherry of the Carrizo Sands of Texas, 325
Corydalis flavula, 358, 383, 412
Corylus, 29; Avellana, 29; rostrata, 29–31
Cotype, Syntype, and other Terms referring to Type Material, 481
Coûdre, 29
"Coûdres" of the "Ysle es Couldres", The, 29
Couldre, 29, 31
Crabapples, 360
Crassulaceae, 311
Crepis nana, 316
Cronquist, Arthur, Identity of Aster salsuginosus Richardson, 262
Cruciferae, 311
Cryptogams, 515, 516
Cuphea ignea, 26; platycentra, 26
Cuscuta, 368, 416; compacta, 416, An unusual Habitat for, 416
Cyanococcus, 451
Cynoctonum sessilifolium, 374–376, 457

Cyperaceae, 105, 308
Cyperus, 451; densicaespitosus, 377; × Weatherbianus, 451
Cypripedium passerinum, 308

Dactylogramma, 234; cinnoides, 232, 234, 239, pl. 757
Danthonia, 239, 254, Notes on, 239–246; Alleni, 240–242, 244, 245; compressa, 239–242, 245, 376, 385; Faxoni, 241, 244, 245; glumosa, 242; intermedia, 240; pinetorum, 243; sericea, 240, 245; spicata, 239–243, var. compressa, 245, var. longipila, 240, 242, 244, 385; spicata pinetorum, 243; spicata, var. pinetorum, 240, 242, 243, var. **typica, 242,** var. villosa, 240, 243, thermalis, 243
Date of Publication of Pursh's Flora Americae septentrionalis, 415
Date of Pursh's Flora, Further Note on the, 511
Decodon, 380
Delphinium scopulorum, var. glaucum, 310
Deschampsia, New Species of, 414; **congestiformis, 414;** elongata, 414; holciformis, 414
Descurainia Richardsonii, 311
Development of a Leafy Axis upon the Cones of Tamarack, 106
Dicentra spectabilis, 442, 444
Dichondra evolvulacea, 275; repens, var. caroliniensis, 275
Digitaria serotina, 371, 385
Dilepyrum aristosum, 260; erectum, 260
Dielytra spectabilis, 442
Dirca, 118, 119; palustris, 117, Fruit of, 117
Double-flowered Form of Gillenia trifoliata, A, 215
Draba alpina, 311, var. nana, 311; glabella, 311; nivalis, 311
Dracocephalum denticulatum, 461
Drosera, 372; capillaris, 372, 413; rotundifolia, 371, 412
Dryas integrifolia, 312
Dunes of Texas, The Senecio on the Coastal, 164
Dutilly, Artheme, (Introduction by) Taraxacum in Arctic Canada (east of 100° W.), 337
Dwarf Trillium of Southeastern Virginia, The, 396, pls. 772, 773

Eastern Extension of Cirsium Flodmani, 356
Edible Plants (Review), 515
Edible Wild Plants of Eastern North America (Review of), 515
Edwards Plateau of Texas, The Perennial Helenium of the, 109
Egler, Frank E., The Seashore State Park, a Part of Cape Henry, Virginia, 105
Elaeagnaceae, 313
Eleocharis microcarpa, 372; pauciflora, var. Fernaldii, 280
Elychrysum foliis oblongis etc., 478
Epilobium angustifolium, 313; latifolium, 313
Epipactis gigantea, 267
Equisetaceae, 308
Equisetum palustre, 308
Erianthus, 249, 250, 255; alopecuroides, 249, 251, 252, 254, 255, pl. 761, var. brevibarbis, 246; brevibarbis, 246–250, 255, pls. 759, 760, and other Species, 246; **coarctatus, 246**–249, 255, **pl. 758,** var. **Elliottianus, 246,** 248; compactus, 249, 251, 252; divaricatus, 252, 255, pl. 761; giganteus, 249–251; saccharoides, 249–252, subsp. brevibarbis, 248, var. **compactus, 252;** strictus, 249
Ericaceae, 314
Erie County, New York, Alchemilla pratensis in, 27
Erigeron, 263, 361; callianthemus, 263, 264; carolinianum, 413; elatus, 316; peregrinus, 264, subsp. **callianthemus, 264;** philadelphicus, 361; radicatus, 316; salsuginosus, 263; scaturicola, 361; strigosus, f. discoideus, 478; unalaschkensis, 316
Erigerons, 264
Eriophorum Chamissonis, f. albidum, 308; medium, 308; vaginatum, 308; virginicum, 405
Erodium cicutarium, 270
Eryngium, 373–375, 381; prostratum, 373, 454
Erysimum cheiranthoides, 277; inconspicuum, 311
Eulalia, 389; aurea, 389; viminea, 389, var. variabilis, 389
Eupatorium, 371; cuneifolium, 461; pubescens, 478; recurvans, 461; rotundifolium, 379, 478, var. **cordigerum, 477,** 478, var. ovatum, 478
Euphorbia corollata, 370, var. paniculata, 453; Ipecacuanhae, 370; marilandica, 370

Euphorbiaceae, 444
Euphrasia purpurea, 112, f. candida, 112, var. Farlowii, f. iodantha, 112, var. Randii, f. albiflora, 112; Randii, f. **albiflora, 112,** var. Farlowii, f. **iodantha, 112,** var. **Reeksii, 112,** f. **candida, 112**
Euthamia camporum, var. tricostata, 413; galetorum, 413; media, 413; pulverulenta, 413; remota, 413
Evans, Alexander W., Microchemical Studies on the Genus Cladonia, Subgenus Cladina, 417
Expedition of 1939–1941, Botanical Collections of the Wood Yukon, 305
Extension of Cirsium Flodmani, Eastern, 356

Fagus, 109
Fern, Royal, 396; Sensitive, 396; Venus-hair, 268
Fernald, M. L., A Flora of Kentucky (Review), 277; An Important Biography (Review), 28; An Invaluable Reference Work (Notice), 56; Centaurea nervosa in America, 331; Eastern Extension of Cirsium Flodmani, 356; Erianthus brevibarbis and other Species, 246; Five Common Rhizomatous Species of Muhlenbergia, 221; Fruit of Dirca palustris, 117; Memorandum regarding James Greenway, 301; Minor Transfers and Forms in Cirsium, 353; Notes on Danthonia, 239–246; Notes on Hieracium, 317; Our Albino Lupine, 356; Our Varieties of Barbarea vulgaris, 304; Our Varieties of Trifolium pratense, 331; (Review of work), 515; Scirpus Longii in North Carolina, 55; Scirpus Peckii in Canada, 168; Studies in North American Species of Scirpus, 279; The Identity of Scleria setacea of Poiret, 296; The Quebec Stations for Scirpus Peckii, 518; Trifolium hybridum and its Var. elegans, 331; Trillium undulatum forma Cleavelandicum, 517; Two later Homonyms, 111; Vicia tetrasperma, Var. tenuissima in America, 480; Virginian Botanizing under Restrictions, 357–413, 445–480, 485–511, pls. 770–806; What is Angelica triquinata?, 298; Why not Andropogon Gerardi?, 255
Ferula villosa, 298–301
Five common Rhizomatous Species of Muhlenbergia, 221–239, pls. 749–757
Flora Americae septentrionalis, Date of Publication of Pursh's, 415
Flora, Further Note on the Date of Pursh's, 511; of Arizona (Review) 26; of Kentucky (Review), A, 277
Flowering Plants and Ferns of Arizona (Review of), 26
Flourensia, 353
Fly-poison, 374
Form of Gillenia trifoliata, A Double-flowered, 215; of Prunus virginiana from Indiana and Illinois, New, 354
Forms in Cirsium, Minor Transfers and, 353
Formica, 440; fusca subsericea, 445; neogagates, var., 445
"Fossil Evidence of wide Post-Pleistocene Range for Butternut and Hickory in Wisconsin", Note on, 107
Foster, Robert C., Flora of Arizona (Review), 26
Fragaria glauca, 312; sterilis, 111
Franseria tomentosa, 116
Frasera, 26
Fraxinus, 108; americana, 274; pennsylvanica, var. Austini, 273, var. typica, 273; texensis, 274
Fruit of Dirca palustris, 117
Fumaria officinalis, 412
Fumariaceae, 444
Further Note on the Date of Pursh's Flora, 511

Galium boreale, 315; pilosum, 276; proliferum, 276; texense, 276; virgatum, 276
Gates, Burton N., Carunculate Seed Dissemination by Ants, 438
Gentiana cherokeensis, 365, 366; falcata, 314; nana, 314; procera, 314; propinqua, 314; prostrata, 314
Gentianaceae, 314
Genus Aster in Nova Scotia, 344; Cladonia, Subgenus Cladina, Microchemical Studies on the, 417
Geographic Varieties and Allies in eastern North America, Senecio aureus and its, 495–509, pls. 800–806

Geographical Guide to Floras of the World (Review of), 56
Geranium sect. Caespitosa, 6, 8, **52, sect. Mexicana,** 6, 8, 52, sect. Sylvatica, 6, 8; albiflorum, 5, 33, 35, *β.* incisum, 15, 25, *β.*? incisum, 15; atropurpureum, 48, 50, 51, var. furcatum, 45; **attenuilobum,** 8, 9, 26, **40,** 41; "caespitose", 47, 49; caespitosum, 8, 10, 38, 39, 41, 45–47, 50, f. albiflorum, 48; caespitosum gracile, 45; **californicum,** 8, 10, **38,** 41; canum, 23; **concinnum,** 8, 10, **36,** 38; Cowenii, 8, 9, 41, 42; eremophilum, 8–10, 38, 46, 47; erianthum, 5, 6, 8, 9, 13, 16, 17, 22; Fremontii, 8, 9, 23, 41, 42, 44, 46, 47, 50, var. Parryi, 43; Fremontii Parryi, 43; furcatum, 45, 46; gracile, 47, 51; gracilentum, 33, 35, 36; Hookerianum, 33, *β.* incisum, 22; incisum, 15, 16, 20, 23, 25, 39; lentum, 6, 8, 10, 51–53; leucanthum, 39; loloense, 33, 36; maculatum, 5, 6, 8, 10, 13, 14, 17, 19, 22; maculatum *β.*, 15, 16; maculatum, f. albiflorum, 11, var. albiflorum, 11, var. album, 11, var. plenum, 11; marginale, 8, 9, 41, 42; mexicanum, 53; nervosum, 23, 24, 36; of the United States and Canada, Revision of the Perennial Species of, 5–26, 32–53; oreganum, 8, 9, 13, 14, 16, 17, 19, 25; Parryi, 8, 9, 42, 44, 46, 52; Pattersonii, 43, 44; pentagynum, 33; pratense, 6, 8, 9, 13, 19; Richardsonii, 8, 10, 16, 17, 22, 25, 32, 35, 36, 38–40, var. intermedia, 43; robertianum, 49; strigosius, 8, 9, 16, 17, 21, 22, 25, 26, 36, 38, 39, 41; strigosum, 23–25; sylvaticum, 8; viscosissimum, 8, 9, 17, 19, 21–23, 25, 38, f. album, 20, var. album, 20; Wislizeni, 6, 8–10, 51, 53
Gilia, 27
Gillenia trifoliata, 215, A Double-flowered Form of, 215; trifoliata, f. **multipetala, 216**
Glycyrrhiza lepidota, var. glutinosa, 378, 453
Gnaphalium americanum, 479; obtusifolium, var. Helleri, 380, 480, var. micradenium, 380, 480; **peregrinum, 479, pl. 795;** platense, 479; purpureum, 479; spathulatum, 478, 479, a later Homonym, 478, pl. 795; spatulatum, 478
Goldenrod, 377
Gramen dactylon, villosum, etc., 255
Gramineae, 222, 248, 277, 308, 389
Gratiola aurea, 215; virginiana, var. aestuariorum, 380, 476
Gray Herbarium of Harvard University, Contributions from the— No. CXLVII, pp. 57–105, 119–163, 171–214, pls. 746–748; No. CXLVIII, pp. 221–258, 279–303, 317–325, pls. 749–769; No. CXLIX, pp. 357–413, 445–480, 485–511, pls. 770–806
Greenway, Memorandum regarding James, 301
Greenwaya, 304
Gutierrezia, 353

Habenaria integra, 55; nivea, 55
Habitat for Cuscuta compacta, An unusual, 416
Haglund, Gustaf, Taraxacum in Arctic Canada (east of 100° W.), (Introduction by Artheme Dutilly), 337
Hamamelis virginiana, 450, var. parvifolia, 450
Haplopappus, 351, from Southwestern Texas, New Species of, 351; annuus, 352; **Havardii, 352;** phyllocephalus, 351
Harris, Stuart K., Notes on Solidago, Section Euthamia, 413
Harvard University, Contributions from the Gray Herbarium of— No. CXLVII, pp. 57–105, 119–163, 171–214, pls. 746–748; No. CXLVIII, pp. 221–258, 279–303, 317–325, pls. 749–769; No. CXLIX, pp. 357–413, 445–480, 485–511, pls. 770–806
Hazelnut, 30, 31
Hedeoma acinoides, 275
Hedysarum alpinum, var. americanum, 313; Mackenzii, 313
Helenia, 485; autumnalis, 490; decurrens, 490; foliis decurrentibus, etc., 485, 495, pl. 797
Heleniastrum, 485; folio breviore, etc., 486; folio longiore, etc., 486, 487
Helenium, 109, 110, 379, 485, 490; Some Varieties and Species of, 485–495, pls. 796–799; altissimum, 490; autumnale, 109–111, 485–492, 495, pl. 796, var. *β.*, 489,

var. canaliculatum, 488, 490, 492, 495, pl. 797, var. grandiflorum, 489, 491, var. **montanum, 491,** 492, var. **parviflorum,** 490, **492,** 495, pl. 798, var. pubescens, 491; autumnale pubescens, 491, 492; canaliculatum, 487, 488, 490, 491, 495, pl. 797; edwardsianum, 110, 111; **floridanum, 494,** 495, **pl. 799; Godfreyi, 494,** 495, **pl. 799;** grandiflorum, 491; huronense, 491; latifolium, 110, 111, 486, 488, 490; longifolium, 488, 491, 492; montanum, 110, 111, 491; nudiflorum, 493–495, pl. 799; of the Edwards Plateau of Texas, The Perennial, 109; parviflorum, 489, 492, 493, 495, pl. 798; polyphyllum, 493, 494; pubescens, 490, 492; pumilum, 490; quadridentatum, 487
Heleniums, 109
Helianthus angustifolius, 365
Helichrysum crispum, 479; spatulatum, 479
Henbit, 382
Herbarium of Harvard University, Contributions from the Gray—No. CXLVII, pp. 57–105, 119–163, 171–214, pls. 746–748; No. CXLVIII, pp. 221–258, 279–303, 317–325, pls. 749–769; No. CXLIX, pp. 357–413, 445–480, 485–511, pls. 770–806
Heuchera villosa, 448
Hexastylis, 374, 399
Hickory, 377
Hieracium, 325; Notes on, 317–325; sect. Vulgata, 317–319; auratum, 321; canadense, 320–322, [subsp.] columbianum, 321, var. columbianum, 320, 321, var. **fasciculatum, 320**–322, var. hirtirameum, 321, 322, var. latifolium, 321, var. macrophyllum, 321; columbianum, 320, 321; fasciculatum, 320; groenlandicum, 318, 319; Gronovii, 323, 325, var. foliosum, 325, var. *β*. foliosum, 325, var. *α*. nudicaule, 323, 325; Kalmii, 322; laevigatum, subsp. canadense, 321; macrophyllum, 320, 321; marianum, 325; molle, 318; murorum, 319; **Robinsonii, 317**–319; sabaudum, 322; scabrum, 325; smolandicum, 317, subsp. Robinsonii, 317; venosum, 323–325, 511, var. Blombergii, 323–325, var. nudicaule, 323, 511, var. *β*. subcaulescens, 323; virgatum, 321, 322; vulgatum, 317–319
Holosteum umbellatum, 359, 400
Homonyms, Two later, 111
Hopkins, Milton, Edible Plants (Review), 515; Notes from the Bebb Herbarium of the University of Oklahoma—II, 265; Notes on Oklahoma Plants, 113
Hull, Edwin D., Lilium michiganense, L. canadense and L. superbum, 512; Tragopogon dubius in Indiana, 413
Hydrolea quadrivalvis, 377, 459
Hyland, F., New Combination in Pyrus, 28
Hypericum denticulatum, var. ovalifolium, 373, 453; setosum, 374–376, 453

Identity of Aster salsuginosus Richardson, 262; of Scleria setacea of Poiret, The, 296
Ilex coriacea, 461; vomitoria, 461
Illinois, New Form of Prunus virginiana from Indiana and, 354
Important Biography (Review), An, 28
Indiana and Illinois, New Form of Prunus virginiana from, 354
Indiana, Tragopogon dubius in, 413
Invaluable Reference Work (Notice), 56
Iris, 360; arizonica, 26; verna, 360, 362, 363, pl. 770
Ischaemum, 389
Isolepis oligantha, 280
Ivy, Japanese, 416

Jacobaea virginiana, 495
Japanese ivy, 416
Jatropha texana, 271
Johnny-Jump-up, 444
Jones, Florence Freeman, Revision of the Perennial Species of Geranium of the United States and Canada, 5–26, 32–53
Jones, George Neville, New Form of Prunus virginiana from Indiana and Illinois, 354; Revision of the Perennial Species of Geranium of the United States and Canada, 5–26, 32–53
Juglans, 107, 108; cinerea, 107
Juncus canadensis, 295
Juniperus mexicana, 275; monosperma, 117

Kalmia latifolia, 382, 510
Kearney, T. H. (Review of work), 26
Kentucky Plants (Review), A Check-list of, 278; (Review), A Flora of, 277
Kinsey, A. C. (Review of work), 515
Kuhnia eupatorioides, 376

Lachnanthes tinctoria, 55
Lady-fern, 396
Lady's Mantle, 27
Lagotis glauca, 315, var. lanceolata, 315
Lakela, Olga, Rediscovery of Caltha natans in Minnesota, 53
Lamium, 382
Larch, European, 107
Larix laricina, 106
Larrea, 353
Lasius americanus, 440, 445; niger, var. americanus, 445
Later Homonyms, Two, 111
Lathyrus venosus, 270, var. meridionalis, 269
Leafy Axis upon the Cones of Tamarack, Development of a, 106
Lechea, 457
Ledum groenlandicum, 314
Leguminosae, 313
Lemon, Paul C., Carex flexuosa in Minnesota, 167
Lepidium virginicum, 382
Lesquerella globosa, 278
Leucojum aestivum, 359
Li, Hui-Lin, On the Sino-Himalayan Species of Shortia and Berneuxia, 333
Liatris graminifolia, var. Smallii, 478
Licorice, 378
Ligusticum canadense, 378
Liliaceae, 308, 443
Lilium canadense, 394, 395, 512–515, pl. 771, and L. superbum, Lilium michiganense, 512; canadense, var. **editorum, 393**–395, **pl. 771**; canadense, f. rubrum, 394; michiganense, 394, 395, 512, 514, L. canadense and L. superbum, 512; superbum, 395, 512–515, Lilium michiganense, L. canadense and, 512
Lily, 512, 513
Limnobium Spongia, 461
Linaceae, 313
Linaria canadensis, f. **albina, 476**; Lewisii, 313; perenne, 329
Liquidambar, 108
Lobelia Boykinii, 55; Canbyi, 55; elongata, 461; glandulifera, 377, 477; siphilitica, 477, f. **laevicalyx, 476**
Loeflingia texana, 268
Long-leaf Pine, 369, 374–376
Lophiola americana, 55, 415; aurea, 415, 512; septentrionalis, 55
Ludwigia alata, 461; pilosa, 461
Lupine, Our Albino, 356
Lupinus arcticus, 313; perennis, 356, f. **leucanthus, 356,** f. roseus, 356, var. occidentalis, f. albiracemus, 356, f. bicolor, 356
Lychnis apetala, 310
Lythrum lineare, 272

Macleaya cordata, 444
Maine, Polygonum puritanorum in, 215
Malus, 450, 451; angustifolia, var. puberula, 450; Halliana, 451
Marsh Muhly, 222, 223, 231
McFarland, Frank T. (Review of work), 278
Medeola, 396
Medicago minima, 115
Memorandum regarding James Greenway, 301
Merathrepta compressa, 245; pinetorum, 243; spicata, 242; thermalis, 243, var. pinetorum, 243
Mertensia paniculata, 315
Mexico, The Broad-leaved Species of Potamogeton of North America north of, 57–105, 119–163, 171–214, pls. 746–748
Micranthemum umbrosum, 367
Microchemical Studies on the Genus Cladonia, Subgenus Cladina, 417
Minnesota, Carex flexuosa in, 167; Rediscovery of Caltha natans in, 53
Minnesota-Ontario Border, New Oxytrope of the, 1, pl. 745
Minor Transfers and Forms in Cirsium, 353
Monotropsis, 364; odorata, 363
Morphological Differentiation of Clematis ochroleuca and Allies, 401, pls. 776–782
Muenscher, W. C., Potamogeton Spirillus may grow as an Annual, 329
Muhlenbergia, 221, 223, 226, 229, 235, 255, 379, Five Common Rhizomatous Species of, 221–239, pls. 749–757; ambigua, 236, var.

filiformis, 236; brachyphylla, 365, 366, 380; calycina, 237; commutata, 235; erecta, 260, 261; foliosa, 221, 222, 224, 226, 228, 229, 235, 236; foliosa ambigua, 236; foliosa, f. ambigua, 236; foliosa setiglumis, 236; **frondosa, 235**, 379, pls. 749, 750, f. **commutata, 235**; glabriflora, 227, 379, 385; glomerata, 231, 232, 234, 237, 239, var. ramosa, 231, 232, 237; lateriflora, 226, 227; mexicana, 221, 223, 224, 226, 227–230, 235, 236, 238, pls. 751, 752, f. **ambigua, 236**; mexicana commutata, 235; mexicana f. commutata, 236, var. commutata, 235; mexicana filiformis, 236; mexicana, f. setiglumis, 236; racemosa, 221, 222, 224, 231, 232, 237, 238, pls. 753, 754, var. ramosa, 237; setiglumis, 236; setosa, 222, 231–233, 235, 237–239, pls. 755, 756, var. **cinnoides,** 233, **238,** 239, pl. 757; sylvatica, 221, 222, 224, 230, 231, 235, 237, var. **robusta, 236,** 237, var. setiglumis, 236
Muhly, 223; Marsh, 222, 223, 231; Wire-stem, 223
Muley, 222
Myosotis alpestris, 315; verna, 459
Myrmica emeryana, 445; fracticornis, 445

Narcissus biflorus, 398
Nemophila microcalyx, 383, 459
New Amsonia from the Ozarks of Arkansas, 328; Combination in Pyrus, 28; Form of Prunus virginiana from Indiana and Illinois, 354; Oxytrope of the Minnesota-Ontario Border, 1, pl. 745; Species of Deschampsia, 414; Species of Haplopappus from Southwestern Texas, 351; Streptanthus from the Big Bend of Texas, 258
New York, Alchemilla pratensis in Erie County, 27; Scabiosa Columbaria in Central, 220
North America north of Mexico, The Broad-leaved Species of Potamogeton of, 57–105, 119–163, 171–214, pls. 746–748
North Carolina, Scirpus Longii in, 55
Norton, Arthur Herbert, 217
Note on "Fossil Evidence of wide Post-Pleistocene Range for Butternut and Hickory in Wisconsin", 107; on the Date of Pursh's Flora, Further, 511; on the Term Phyllary, 502
Notes from the Bebb Herbarium of the University of Oklahoma—II, 265; on Danthonia, 239–246; on Hieracium, 317–325; on Oklahoma Plants, 113; on Solidago, Section Euthamia, 413
Nothoscordum bivalve, 360, 364, 393
(Notice) An Invaluable Reference Work, 56
Nova Scotia, Genus Aster in, 344
Nymphaea odorata, f. rubra, 400
Nymphaeaceae, 443

Oak, 377
Oenothera, 366; tetragona, var. riparia, 366, 454
Ogden, E. C., The Broad-leaved Species of Potamogeton of North America north of Mexico, 57–105, 119–163, 171–214, pls. 746–748
Oklahoma—II, Notes from the Bebb Herbarium of the University of, 265; Plants, Notes on, 113
Oldenlandia, 372; Boscii, 371, 372, 476
On the Sino-Himalayan Species of Shortia and Berneuxia, 333
Onagraceae, 313
Oplismenus, 389
Orchid, 267, 268
Orchidaceae, 308
Our Albino Lupine, 356; Varieties of Barbarea vulgaris, 304; Varieties of Trifolium pratense, 331
Oxalidaceae, 27
Oxyria, 510
Oxytrope, 1; of the Minnesota-Ontario Border, New, 1, pl. 745
Oxytropis sp., 313; gaspensis, 3, 4; gracilis, 313; hudsonica, 1–4; **ixodes, 2–4, pl. 745,** f. **ecaudata, 4, pl. 745;** pygmaea, 313; viscida, 3; viscidula, 3, 4
Ozarks of Arkansas, New Amsonia from the, 328

Panicum, 277, 369, 372, 381; aciculare, 376, 386; auburne, 386; ensifolium, 386; flexile, 378, 386; huachucae, 277; leucothrix, 55; Lindheimeri, 277; longifolium, var. pubescens, 381, 386; lucidum, 376; mundum, 386; sphaerocarpon, var. inflatum, 386;

spretum, 372; tennesseense, 277; tenue, 386; Wrightianum, 371, 372, 386
Pansy, 444
Papaver alaskanum, 311
Papaveraceae, 311, 444
Parmelia cetrarioides, var. typica, 418, 427
Parnassia Kotzebuei, 311; montanensis, 311; palustris, var. neogaea, 311
Paronychia canadensis, 400; riparia, 370, 400
Parthenocissus tricuspidata, 416
Part of Cape Henry, Virginia, the Seashore State Park, 105
Paspalum, 277; circulare, 277; dissectum, 372, 386; fluitans, 377, 386; laeve, 277
Pastinaca triquinata, 299, 301
Pears, 450, 451
Pease, Arthur Stanley, Polygonum puritanorum in Maine, 215
Pedicularis capitata, 315; labradorica, 315; sudetica, 315; verticillata, 315
Peeples, R. H. (Review of work), 26
Penstemon Gormanii, 315
Pentameris compressa, 245; spicata, 243; thermalis, 243
Peppergrass, 382
Perennial Helenium of the Edwards Plateau of Texas, The, 109; Species of Geranium of the United States and Canada, Revision of the, 5–26, 32–53
Phacelia dubia, 383, 459
Phanerogams, 515
Phaseolus coccineus, 169, 170; polystachios, 169, 170, to other Species, Probable Relationship of, 169; vulgaris, 169, 170
Philadelphus inodorus, 358, 450
Phlox carolina, var. triflora, 365, 459; Hentzii, 383, 459; nivalis, 383, 459; Richardsonii, 314
Phryma Leptostachya, 115, 274, var. confertifolia, 115
Phyllary, Note on the Term, 502
Physalis monticola, 370, 476
Physostegia, 275, 368; **aboriginorum, 459**–461, 464, **pl. 783**; **angustifolia, 462,** 464, **pl. 785**; denticulata, 368, 460–464, pl. 784; granulosa, 463, 464, pl. 786; intermedia, 462; leptophylla, 460; purpurea, 461; speciosa, 462; veroniciformis, 460; virginiana, 462, 463, var. **granulosa, 464,** pl. 786, var. speciosa, 463
Phytolacca, 378; americana, 378; decandra, 378
Picea, 108, 309; glauca, 308; mariana, 106
Pinaceae, 308
Pine, Long-leaf, 369
Pinus, 108, 452; echinata, 272; edulis, 117; palustris, 375; ponderosa, 117; serotina, 461
Pisum, 169
Plants, Notes on Oklahoma, 113; (Review), Edible, 515
Plateau of Texas, The Perennial Helenium of the Edwards, 109
Poa arctica, 308
Podosaemum glomeratum, 237
Poke, 378, 379
Polemoniaceae, 314
Polemonium acutiflorum, 314; boreale, 315; pulcherrimum, 315; Richardsonii, 315
Pollinia, 389; imberbis, var. genuina, 389, var. Willdenowiana, 389
Polycodium, 451, 456; interius, 456
Polygala sanguinea, 366, 453; Senega, var. latifolia, 378, 453
Polygalaceae, 444
Polygonaceae, 310
Polygonum, 215; Bistorta, 310; Persicaria, 215; puritanorum, 215, in Maine, 215; viviparum, 310
Polypogon glomeratus, 232, 234, 237, 239, pl. 756; racemosus, 237; setosus, 234, 235, 237, 238, pl. 755
Polypremum, 457; procumbens, 457
Polytrichum, 435
Poncirus trifoliata, 358
Pondweed, 329
Populus, 309; tacamahacca, 309
Portulacaceae, 310
Potamogeton, 329, 330; subg. Coleogeton, 71, 192, sect. Connati, 70, sect. Convoluti, 71; subg. Eupotamogeton, 71, 192, sect. Axillares, 71, sect. Adnati, 71; subsect. Alpini, 63, 68, 69, 71, 72, 76; subsect. Amplifolii, 63, 68, 69, 71, 72, 76, 132; subsect. Colorati, 60, 63, 68, 69, 71, 72, 76; subsect. Compressi, 71; subsect. Crispi, 60, 61, 68, 69, 71, 72, 76; subsect. Filiformes, 70; subsect. Hybridi, 71, ser. Euhybridi, 71; subsect. Javanici, 71; subsect. Lucentes, 60, 61, 63, 64, 68, 69, 71, 73, 76, 133, 158, 159; subsect. Monticoli,

71; subsect. Natantes, 60, 63, 68, 69, 71, 74, 76; subsect. Nodosi, 61, 63, 68, 69, 71, 73, 76, 134; subsect. Nuttalliani, 71; subsect. Oxyphylli, 71; subsect. Pectinati, 71; subsect. Perfoliati, 60, 61, 63, 64, 68, 69, 71, 74, 76; subsect. Praelongi, 60, 61, 63, 68, 69, 71, 74, 76; subsect. Pusilli, 71, ser. Pusilli connati, 71, subser. Foliosi, 71, subser. Panormitani, 71, ser. Pusilli convoluti, subser. Acuti, 71, subser. Obtusi, 71; subsect. Serrulati, 71; subsect. Vaginati, 71; group Amplifolii, 192; alpinus, 58, 61, 62, 71, 72, 76, 89, 90, 94–97, 138, 184, 191, var. Faxoni, 183, 185, proles microstachys, 92, var. **subellipticus,** 90–**94,** 97, 98, 195, pl. 746, subsp. tenuifolius, 92, var. **tenuifolius, 90,** 91, 95, 97, 157, 183, 195, pl. 746; alpinus × americanus, 183, 185; alpinus × Claytonii, 185; alpinus × gramineus, 183, 190; alpinus × nodosus, 183; alpinus × pensylvanicus, 185; americanus, 123, 186, var. novaeboracensis, 124; americanus × alpinus, 186; americanus × pensylvanicus, 185, 186; amplifolius, 59–62, 69, 71, 72, 75, 95, 99, 100, 104, 122, 123, 127, 128, 137, 184, 195, 196, pls. 746, 748, var. amphibius, 100, 120, f. amphibius, 100, 105, 120, 123, f. homophyllus, 100, var. ovalifolius, 100, 104, 120, 123; amplifolius × illinoensis, 184; amplifolius × praelongus, 184; amplifolius × Richardsonii, 184; angustifolius, 157, 158, 187, var. connecticutensis, 154, var. methyensis, 191; × argutulus, 185, formseries nodosifolius, 185; Berchtoldi, 71, 192, 194, 195, × perfoliatus, var. bupleuroides, 68, 193; Berchtoldi, var. tenuissimus, 195, var. tenuissimus × perfoliatus, var. bupleuroides, 196, pl. 748; bicupulatus, 71; bupleuroides, 177, 178, 180, 194, × pusillus, 194; capillaceus, 71, 192; × champlainii, 185, 186; Claytonii × Zizii, 188; clystocarpus. 71; coloratus, var. jamaicensis, 124; confervoides, 71; crispus, 58, 60–62, 64, 71, 72, 75, 76, 86–88, 91, 177; × deminutus, 187; diversifolius, 71, 192; epihydrum × angustifolius, 188; epihydrus, 71, 133, × nodosus, 186; epihydrus, var. Nuttallii, 138, 142, 385, × pulcher, 184; Faxoni, 183, 185; × Faxoni, 183, 185; fibrillosus, 71; filiformis, 70; floridanus, 192; fluitans, 66, 90, 97, 100, 120, 124, 129, 130, 132, subsp. americanus, 124, proles novaeboracensis, 124; foliosus, 66, 71, var. macellus, 192; Friesii, 71; gemmiparus, 71; gramineus, 71, 73, 75, 97, 132, 142, 143, 145, 147, 150–152, 183, 184, 187, 189, 191, 195, pl. 746, var. graminifolius, 143; gramineus, f. heterophyllus, 150, f. jemtlandicus, 148, var. lacustris, 144, var. longipedunculatus, 144; gramineus, f. longipedunculatus, 144, var. maximus, 132, 143–146, 148, 151–153, 174, 196, pl. 748, var. minimus, 150, var. myriophyllus, 143, 145, 147, 150, 151, var. spathulaeformis, 151, 187, 189; gramineus, f. terrestris, 144, var. typicus, 143, 149, 151, 196, pl. 748; gramineus, f. Wolfgangii, 148; gramineus × illinoensis, 145, 149, 151, 158, 187, 190; gramineus × illinoensis × lucens, 187; gramineus × lucens, 158, 187; gramineus × natans, 186; gramineus × nodosus, 185; gramineus × perfoliatus, 151; gramineous × perfoliatus, var. bupleuroides, 61, 183, 189; gramineus × Richardsonii, 152, 188, 191, 192; gramineus × Zizii, 187; gramineus × P. sp., 191; Hagströmii, 188, 189; heterophyllus, 132, 143, 148, 150, 157, f. graminifolius, 143, f. longipedunculatus, 143, f. maximus, 148, 187, f. minimus, 150, f. myriophyllus, 150, f. terrestris, 144; Hillii, 71; illinoensis, 71, 73, 75, 93, 94, 150, 152–154, 156–159, 185, 188, 191, 192, 195, pl. 746, f. homophyllus, 154, f. rosulatus, 154; illinoensis × lucens, 187; illinoensis × nodosus, 185; illinoensis × perfoliatus, 191, var. bupleuroides, 191; illinoensis × Richardsonii, 191; illinoensis × P. sp., 192; insulanus, 124, 133; lateralis, 71; latifolius, 70; lonchites, 124, 125, 131, 132, 148, var. novaeboracensis, 124, 131; lonchites × rufescens, 185; longiligulatus, 71; lucens, 90, 92,

97, 154, 157, 158, var. connecticutensis, 154, 155, 158, var. floridanus, 154, 155, var. fluitans, 90, 97, 100, 120, 124; lucens × natans, 129; lucens × nodosus, 185; methyensis, 191; mexicanus, 124, 133; microstachys, 90, 94, var. subellipticus, 94, var. typicus, 92; montanense, 92, 93, 97; montanus, 124; mysticus, 194; × mysticus, 194, 196; natans, 60–63, 71, 74, 75, 102, 103, 120, 127, 134, 135, 138–140, 142, 192, 193, 195, 196, pls. 746, 747, var. fluitans, 124, var. prolixus, 135, 139, 140; natans, f. submersus, 139, var. terrestris, 139, var. typicus, 139, var. vulgaris, 139; natans × gramineus, 186; natans × nodosus, 185; × nericius, 183; nitens, 188, 189; × nitens, var. subgramineus, f. restrictus, 189; nodosus, 59–62, 66, 71, 73, 75, 104, 123, 127, 131–134, 186, 195, 196, pls. 746, 748; nodosus × epihydrus, 125; nodosus × natans, 185; nodosus × Nuttallii, 186; nodosus × Richardsonii, 186; Nuttallii, 133, var. portoricensis, 124, 133; Oakesianus, 60–63, 71, 74, 75, 127, 140, 142, 193, 195, pl. 746; obrutus, 90, 93; obtusifolius, 71; occidentalis, 123, 134; of North America north of Mexico, The Broad-leaved Species of, 57–105, 119–163, 171–214, pls. 746–748; panormitanus, 192; pectinatus, 71, 192; pennsylvanicus, var. portoricensis, 124; pensylvanicus, 133; perfoliatus, 58–61, 66, 71, 75, 76, 163, 174–178, 180, 181, 193, 194, var. bupleuroides, 171, 174, 175, 177, 178, 181, 182, 189, 190, 193–196, pls. 746, 748, × Richardsonii, 193; perfoliatus, var. gracilis, 163, 177, 180, var. lanceolatus, 163, subsp. Richardsonii, 163, var. Richardsonii, 163, var. **typicus, 177,** 180, 181; × perplexus, 155, 157, 185; plantagineus, var. jamaicensis, 124, 134; polygonifolius, 58, 59, 71, 72, 75, 91, 98, 195, pl. 746; Porsildiorum, 71; Porteri, 71; praelongus, 58, 60, 61, 63, 71, 74, 75, 122, 159, 160, 162, 174–176, 195, pl. 746, f. elegans, 162; praelongus × Richardsonii, 193; Proteus heterophyllus, 143; Proteus lucens, 154; Proteus Zizii, 154, 187; × pseudolucens, 154, 187; × pseudo-Zizii, 187; pulcher, 59, 61, 62, 71, 73, 75, 103, 104, 119, 120, 122, 123, 127, 192, 195, pl. 746, f. amphibius, 121; × pulcher, 385; Pursh ii, 140; pusillus, 71, 192, 194; × rectifolius, 183, 186; Richardsonii, 58–61, 71, 75, 76, 87, 149, 162, 163, 174–176, 191, 193, 195, pl. 746; Robbinsii, 71; rotundatus, 124, 131–133; rufescens, 90, 92, "forma angustifolia", 90; × scoliophyllus, 184, f. barensis, 184; × sparganifolius, 186; spathaeformis, 187; × spathaeformis, 187; spathulaeformis, 157, 187; × spathuliformis, 187; Spirillus, 71, 329, 330, may grow as an Annual, 329; strictifolius, 71; × subdentatus α. sessilis, 191, β. petiolatus, 188, 189, 191; × subnitens, 189, 190; × subobtusus, 183; × subrufus, 185, 186; × subsessilis, 186; tennesseensis, 71; tenuifolius, 90, 92, 97, var. subellipticus, 94, 97; Tepperi, 192; vaginatus, 71; varians, 187; Vaseyi, 71, 330; Zizii, 97, 154, 158, 187; var. connecicutensis, 154, var. gracilis, 154, 187, var. methyensis, 191, var. porrectifolius, 154, 187; × Zizii, f. pulcherrimus, 187; zosteriformis, 71

Potentilla biflora, 312; diversifolia, 312; emarginata, 111, 112, c. elatior, 111; fruticosa, 312; hyparctica, 112, var. **elatior, 111,** 112; nivea, 312; pectinata, 312; uniflora, 312

Prasium? purpureum, 461, 462, pl. 785

Prenolopis imparis, 440, 441, 445

Probable Relationship of Phaseolus polystachios to other Species, 169

Proserpinaca intermedia, 373, 454

Prunus, 451; demissa, 355; eximia, 327; melanocarpa, 355, f. Rydbergii, 355; **Parksii, 326;** serotina, 327; virens, 325; virginiana, 354, 355, from Indiana and Illinois, New form of, 354, f. **Deamii 355,** var. demissa, 355

Psoralea, 366; psoralioides, var. eglandulosa, 366, 452

Publication of Pursh's Flora Americae septentrionalis, Date of, 415

Pursh's Flora Americae septentrionalis, Date of Publication of, 415
Pursh's Flora, Further Note on the Date of, 511
Pycnanthemum pycnanthemoides, var. viridifolium, 476; verticillatum, 475
Pyrola grandiflora, 313; rotundifolia, var. americana, 377, 455
Pyrolaceae, 313
Pyrus, 450, 451; americana, var. decora, 28; betulaefolia, 451; communis, 451, × pyrifolia, 450; **decora, 28;** × Lecontei, 450; New Combination in, 28; serotina, 451

Quebec Stations for Scirpus Peckii, The, 518
Quercus, 108, 109, 452

Ranunculaceae, 310
Ranunculus abortivus, var. indivisus, 358, 401; hispidus, 359; parviflorus, 360; reptans, 311; Sardous, 401
Raphanus, 277
Red Clover, 331
Rediscovery of Caltha natans in Minnesota, 53
Reference Work (Notice), An Invaluable, 56
Relationship of Phaseolus polystachios to other Species, Probable, 169
Restrictions, Virginian Botanizing under, 357–413, 445–480, 485–511, pls. 770–806
(Review), A Check-list of Kentucky Plants, 278; Edible Plants, 515; Flora of Arizona, 26; A Flora of Kentucky, 277
Revision of the Perennial Species of Geranium of the United States and Canada, 5–26, 32–53
Rhexia aristosa, 55; ventricosa, 366, 454
Rhizomatous Species of Muhlenbergia, Five Common, 221–239, pls. 749–757
Rhododendron, 451; lapponicum, 314
Rhynchospora, 297, 451; filifolia, 372, 393; perplexa, 372; setacea, 297
Ricinus, sp., 439, 444, 445; communis, 444
Rodgers, III, Andrew Denny (Review of work), 28
Rosa acicularis, 312
Rosaceae, 312
Rose family, 27
Rossbach, George B., Development of a Leafy Axis upon the Cones of Tamarack, 106
Royal Fern, 396
Rubiaceae, 315
Rubus, 374, 384; Chamaemorus, 313
Rudbeckia columnaris, 512
Ruellia, 370
Rumex, 105, 510

Sabatia, 105
Saccharum, 248
Sagina fontinalis, 277
Sagittaria, 53; Weatherbiana, 367
Salicaceae, 309
Salix, 109; alaxensis, 309; arbusculoides, 309; arctica, 309; Barrattiana, 309; glauca, var., 309, var. acutifolia, 309; niphoclada, 309; polaris, var. selwynensis, 309; reticulata, 309; Richardsonii, 309
Sands of Texas, The Wild Cherry of the Carrizo, 325
Sanguinaria canadensis, 444, 445
Saussurea densa, 316
Saxifraga bronchialis, ssp. Funstoni, 311; caespitosa, 312; flagellaris, 312; Hirculus, 312; oppositifolia, 312; rivularis, 312; serpyllifolia, 312; tricuspidata, 312
Saxifragaceae, 26, 311
Scabiosa Columbaria, 220, 221, in Central New York, 220
Scarlet Runner, 169, 170
Schizocodon, 334, 335; ilicifolius, 334; soldanelloides, 334
Schoenus setaceus, 297
Scirpus § Baeothryon, 279; § Lacustres, 285, Some North American Members of, 283, pls. 765, 766; § Schoenoplectus, 390; acutus, 284, 285; alpinus, 279, 280; americanus, 392; atrocinctus, 55; atrovirens, var. georgianus, f. **angustispicatus, 296,** f. **cephalanthus, 296;** campestris, 291, var. Fernaldii, 290, var. novae-angliae, 288, 290; chilensis, 391, 392; cyperinus, 168; **emergens, 281,** 283, pl. 763; etuberculatus, 392; **expansus, 293**–295, **pl. 767,** f. **Bissellii, 294,** 295, f. **globulosus, 294;** Fernaldi, 289, 290; heterochaetus, 286, 287, pl. 766; lacustris, var. condensatus, 285; lacustris condensatus, 285,

286; Longii, 55, 56, in North Carolina, 55; maritimus, 289–291, var. digynus, 291, var. Fernaldi, 289–292, 393, f. **agonus, 288,** 289, 291, 393; microcarpus, 295, var. Bissellii, 294; novae-angliae, 289–291, 393; Olneyi, 390–392, The Specific Characters of, 390, f. australis, 392; orgyalis, 285; paludosus, 291, 292, var. **atlanticus, 291,** 292; pauciflorus, 280; Peckii, 168, 518, The Quebec Stations for, 518, in Canada, 168; pedicellatus, 56; planifolius, 279; polyphyllus, f. **macrostachys, 296,** var. macrostachys, 296; pumilus, 279–282, pl. 762, The American Representative of, 279, pls. 762–764; robustus, 290, 392, 393, var. novae-angliae, 290; robustus, f. **protrusus, 392; Rollandii, 282, pl. 764;** rubrotinctus, 295, f. **radiosus, 295;** rufus, 283, 287, 288, var. **neogaeus,** 283, **287,** 288, **pl. 763;** Some American Species and Varieties of, 287, pls. 763, 767; **Steinmetzii, 286,** 287, **pl. 766;** Studies in North American Species of, 279–296; subterminalis, 390, f. **terrestris, 288,** var. terrestris, 288; sylvaticus, 293–295, pl. 767, f. Bissellii, 294, var. Bissellii, 294; validus, 284–287, pl. 765, var. **creber, 283,** 284, 287, **pl. 765,** f. **megastachyus, 283,** 285, 287, 392, **pl. 765**

Scleria, 296, 297; Brittonii, 297; flaccida, 461; georgiana, 297; laxa, 296; Muhlenbergii, 296, 297; oligantha, 366; reticularis, 296; setacea, 297, of Poiret, The Identity of, 296; Torreyana, 296

Scrophulariaceae, 315

Scutellaria serrata, 380, 459

Seashore State Park, a Part of Cape Henry, Virginia, The, 105

Sedge, 167

Sedum integrifolium, 311; ternatum, 360

Seed Dissemination by Ants, Carunculate, 438

Senecio, 164, on the Coastal Dunes of Texas, The, 164; aureus, 361, 495–500, 506, 508, pls. 800, 801, and its Geographic Varieties and Allies in eastern North America 495–509, pls. 800–806; aureus × Balsamitae, 500; aureus × tomentosus, 497; aureus, var. Ashei, 497–499, var. **aquilonius,** 497, **500**–502, 509, **pl. 803,** f. **ecoronatus, 502,** var. aurantiacus, 499, var. gracilis, 496, 498, 500, var. **intercursus,** 496, 498, **499,** 502, 508, **pl. 802,** var. semicordatus, 496, 500, 502; Balsamitae, 504, var. firmifolius, 504, 505; Crawfordii, 361, 497, 498, 505, 506; Elliottii, 507; gaspensis, 502, 504, 505, var. **firmifolius, 505,** f. **verecundus, 505;** gracilis, 500; longilobus, 165; lugens, 316; obovatus, 506, 507, var. diversifolius, 507, var. **Elliottii, 507,** var. rotundus, 507, var. umbratilis, 506; pauperculus, 503–505, 509, pl. 804, var. Balsamitae, 502–505, 509, pl. 805, var. firmifolius, 504, 505; pauperculus, f. **inornatus, 502,** var. **neoscoticus, 502,** 503, 509, **pl. 806,** var. praelongus, 503; pauperculus, f. verecundus, 502, 505; plattensis, 503, 505, 507, 508; pseudaureus, 496, 500, f. ecoronatus, 502; pseudo-tomentosus, 507, 508; resedifolius, 316; Riddellii, 165, 166, var. **Parksii, 164;** semicordatus, 500; Smallii, 503–505; tomentosus, 361, 497–499, 506–508, pl. 800

Senn, Harold A., Caltha natans in Canada, 214

Sensitive Fern, 396

Setaria verticillata, 387

Shinners, L. H., Genus Aster in Nova Scotia, 344

Shortia, 333–335, and Berneuxia, On the Sino-Himalayan Species of, 333; sect. Exappendiculata, 334; Davidi, 335; exappendiculata, 334; galacifolia, 333, 334; **ilicifolia, 334;** ritoensis, 334; sinensis, 333–335; soldanelloides, 334, *β.* ilicifolia, 334; subcordata, 334; thibetica, 335; transalpina, 334; uniflora, 334

Shepherdia canadensis, 313

Sherwoodia, 333; sinensis, 335

Shortiopsis, 334

Silene acaulis, var. exscapa, 310

Sino-Himalayan Species of Shortia and Berneuxia, On the, 333

Sium, 367; cicutaefolium, 367, 455; floridanum, 368, 454, 455; suave, 367, 454, 455, f. Carsonii, 455, f. fasciculatum, 455

Snowflake, Summer, 359

Solidago, 369, 377; sect. Euthamia, 413, Notes on, 413; caroliniana, 413; decumbens, var. oreophila, 316; galetorum, 413; graminifolia, var. **media, 413,** var. **remota, 413,** var. septentrionalis, 413, var. **tricostata, 413,** gymnospermoides, var. **callosa, 413;** minor, 413; Moseleyi, 413; multiradiata, 316, var. arctica, 316; patula, 377, 478; perglabra, 413; perlonga, 365, 366; pulverulenta, 413; salicina, 377, 478; tenuifolia, var. pycnocephala, 413; trinervata, 116
Some American Species and Varieties of Scirpus, 287, pls. 763, 767; North American Members of Scirpus, § Lacustres, 283, pls. 765, 766; Varieties and Species of Helenium, 485–495, pls. 796–799
× Sorbaronia, 451
× Sorbopyrus, 451
Sorbus, 451; aria, 451; decora, 28
Sorghastrum Elliottii, 253–255, 376, 390, pl. 761; Linnaeanum, 252, 253; nutans, 252–255
Sorghum nutans, 253, subsp. Linnaeanum, 253
Southwestern Texas, New Species of Haplopappus from, 351
Species of Deschampsia, New, 414; of Geranium of the United States and Canada, Revision of the Perennial, 5–26, 32–53; of Haplopappus from Southwestern Texas, New, 351; of Potamogeton of North America north of Mexico, The Broad-leaved, 57–105, 119–163, 171–214, pls. 746–748; of Shortia and Berneuxia, On the Sino-Himalayan, 333; Probable Relationship of Phaseolus polystachios to other, 169
Specific Characters of Scirpus Olneyi, The, 390
Spirillus amplifolius, 100; heterophyllus, 144; lonchites, 124; lucens, 154; perfoliatus, 177, var. Richardsonii, 163; pulcher, 121; Zizii, 154, 187
Spring-Cress, 515
Spruce, black, 106; bog, 106
Stachys, 369, 473; ambigua, 467, 469, 471–473, 475, pl. 791; arenicola, 471, 474, 475; aspera, 469, 470, var. glabra, 466; cincinnatensis, 466; Clingmanii, 464; glabra, 466; Grayana, 471; hispida, 465, 466, 469–473; homotricha, 474; hyssopifolia, 467, 471–473, 475, pl. 788, var. ambigua, 471; Nuttallii, 465; palustris, 466, 471–473, 475, pl. 792, var. arenicola, 474, var. homotricha, 467, 471, 472, 474, 475, pl. 793, var. macrocalyx, 474, var. nipigonensis, 474, var. **phaneropoda,** 474, **475, pl. 794,** subsp. pilosa, 473, var. **pilosa, 474;** pilosa, 474, subsp. pilosa, 474; pustulosa, 474; Schweinitzii, 474; scopulorum, 474; sylvatica, 472; tenuifolia, 465–467, 470, 473, 475, pl. 787, var. aspera, 469, var. **hispida,** 466, 467, **469**–472, 475, pl. 790, var. **perlonga, 466,** 467, 475, **pl. 788,** var. **platyphylla,** 466–**468,** 470–472, 475, **pl. 789;** velutina, 471, 474
State Park, a Part of Cape Henry, Virginia, The Seashore, 105
Stations for Scirpus Peckii, The Quebec, 518
Stearn, W. T., Date of Publication of Pursh's Flora Americae septentrionalis, 415; Further Note on the Date of Pursh's Flora, 511
Stellaria calycantha, 310; fontinalis, 277; media, var. glaberrima, 360, 400; pubera, 358
Stewartia Malachodendron, 461
Streptanthus, 258; **Cutleri, 259;** from the Big Bend of Texas, New, 258; platycarpus, 260
Studies in North American Species of Scirpus, 279–296; on the Genus Cladonia, Subgenus Cladina, Microchemical, 417
Styrax americana, 372, 457
Summer Snowflake, 359
Sun-flower, Bastard, 486
Swertia, 26
Symplocarpus foetidus, 358
Syntype, and other Terms referring to Type Material, Cotype, 481

Tamarack, 106; American, 107; Development of a Leafy Axis upon the Cones of, 106
Taraxacum, 337; group Ceratophora, 342, 343; group Erythrosperma, 340; alaskanum, 338, 339; croceum, 343; **dentifolium,** 339, **343;** groenlandicum, 339; hyparcticum, 338, 339; hyperboreum, 339; in Arctic Canada (east of 100° W.), 337; lacerum,

338, 339; lapponicum, 339, 343; **Malteanum, 339;** norvegicum, 341, 343; phymatocarpum, 338, 339; **pseudonorvegicum,** 339, **340;** pumilum, 339; **russeolum,** 339, **341; umbrinum,** 339, 341, **342**
Teesdalia nudicaulis, 359
Tephrosia, 369; holosericea, 452; virginiana, 369, 452, var. glabra, 369, 452, var. holosericea, 452
Terms referring to Type Material, Cotype, Syntype and other, 481
Texas, New Species of Haplopappus from Southwestern, 351; New Streptanthus from the Big Bend of, 258; The Perennial Helenium of the Edwards Plateau of, 109; The Senecio on the Coastal Dunes of, 164; The Wild Cherry of the Carrizo Sands of, 325
Thalictrum revolutum, 365
Therorhodion, 451
Thorpe, Heather G., Alchemilla pratensis in Erie County, New York, 27
Tiarella, 379, 380; cordifolia, 380, 446–449, var. austrina, 446, subsp. collina, 445, var. collina, 445–448, var. typica, 446–448, f. parviflora, 448; Wherryi, 445–449
Tilia, 108
Torrey, John, a Story of North American Botany (Review of), 28
Tragopogon dubius, 414, in Indiana, 413; major, 117, 414; porrifolius, 117; pratensis, 117, 413, 414
Transfers and Forms in Cirsium, Minor, 353
Trichochloa calycina, 237; glomerata, 237
Trichophorum emergens, 281
Trifolium, 277; dubium, 277; fistulosum, 331; hybridum, 331, and its Var. elegans, 331, var. elegans, 331; pratense, 331, Our Varieties of, 331; pratense, f. leucochraceum, 331, f. pilosum, 331, var. sativum, 331, f. flavicans, 331; reflexum, 277; stoloniferum, 277
Trillium, 364, 365, 396, 439, 440, 445, 517; Cleavelandicum, 517; erythrocarpum, *β*. Cleavelandicum, 517, var. Cleavelandicum, 517; grandiflorum, 443, 445, 517; lanceolatum, 364, 396–398, pl. 773; Large White, 438; Painted, 517; of Southeastern Virginia, The Dwarf, 396, pls. 772, 773; pusillum, 364, 396, 397, pl. 772, var. **virginianum, 397,** 398, **pl. 773;** sessile, 384, 396; undulatum, 517, f. **Cleavelandicum, 517,** f. polymerum, 517
Tsuga, 108; mertensiana, 108
Two later Homonyms, 111
Type Material, Cotype, Syntype and other Terms referring to, 481
Typha, 113; angustifolia, 113, 114; truxillensis, 113, 114

Ulmus, 109; procera, 358, 398
Umbelliferae, 300
Uncinia, 366
United States and Canada, Revision of the Perennial Species of Geranium of the, 5–26, 32–53
University of Oklahoma—II, Notes from the Bebb Herbarium of the, 265
Unusual Habitat for Cuscuta compacta, An, 416
Utricularia, 381; biflora, 373; cornuta, 215; inflata, 476, var. minor, 371, 372, 476; purpurea, 371, 476; virgatula, 371, 476

Vaccinium, 451; caesium, 456; Elliottii, 370, 456; pallidum, 457; stamineum, 456, var. interius, 456, var. neglectum, 456; Torreyanum, 457; vacillans, 457, var. crinitum, 456; virgatum, 456
Valeriana capitata, 316
Valerianaceae, 316
Varieties of Barbarea vulgaris, Our, 304; of Brachyelytrum erectum, 260; of Trifolium pratense, Our, 331
Venus-hair fern, 268
Verbena officinalis, 476
Vesicaria Shortii, 278
Viburnum Rafinesquianum, 365
Vicia caroliniana, 365, 453; tetrasperma, 480, Var. tenuissima in America, 480
Vilfa, 227
Vinca major, 358
Viola, 440, 442, 443, 445; arvensis, 444; blanda, 444; cucullata, 358, 440, 444, 445, 453; fimbriatula, 444; incognita, 444; lanceolata, 444, 454, var. vittata, 373, 454; odorata, 444; pallens, 444; palmata, 444; pedata, 444; pensylvanica, 359; pubescens, 444; renifolia, 444; striata, 272, 383, 454; tricolor, 444

Missouri Botanical Garden Library
3 1753 00341 3660

Violaceae, 444
Violet, 272, 440
Virginia, The Seashore State Park, a Part of Cape Henry, 105
Virginian Botanizing under Restrictions, 357–413, 445–480, 485–511, pls. 770–806
Vitis, 374

Waterfall, U. T., New Species of Haplopappus from Southwestern Texas, 351; Notes on Oklahoma Plants, 113
Weatherby, C. A., A Check-list of Kentucky Plants (Review), 278; An unusual Habitat for Cuscuta compacta, 416
What is Angelica triquinata?, 298–301
White Ash, 274
Why not Andropogon Gerardi?, 255–258
Wild Cherry of the Carrizo Sands of Texas, The, 325
Willows, 307, 309
Wire-stem Muhly, 223
Wisteria frutescens, 461
Wood Yukon Expedition of 1939–1941, Botanical Collections of the, 305
Woodson, Robert E., Jr., New Amsonia from the Ozarks of Arkansas, 328
Work (Notice) An Invaluable Reference, 56

Xyris, 371

"Ysle es Couldres", The "Coûdres" of the, 29
Yucca, 105
Yukon Expedition of 1939–1941, Botanical Collections of the Wood, 305

Zigadenus elegans, 308
Zizia aptera, 273; Bebbii, 378, 454; cordata, 273; trifoliata, 378, 454